BELL TELEPHONE QUARTERLY

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APRIL, 1933

TABLE OF CONTENTS

Long Distance and a Thrill-Packed Month
H. D. Hocker

A New Service for Business Establishments and the Household
C. J. Davidson

Lightning
H. S. Warren

Communications and Commercial Aviation
R. S. Coe and S. Patterson

The Telephone's Place in Co-Operative Advertising
J. M. Shaw

Myths of Telephone History
W. C. Langdon

Notes on Recent Occurrences

AMERICAN TELEPHONE & TELEGRAPH CO.
NEW YORK

BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

CONTENTS FOR APRIL 1933

PAGE

Long Distance and a Thrill-Packed Month—*H. D. Hocker* 69

A New Service for Business Establishments and the Household —*C. J. Davidson* 76

Lightning—*H. S. Warren* 82

Communications and Commercial Aviation—*R. S. Coe and S. Patterson* . 99

The Telephone's Place in Co-Operative Advertising—*J. M. Shaw* . . . 107

Myths of Telephone History—*W. C. Langdon* 123

Notes on Recent Occurrences 141

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Long Distance and a Thrill-Packed Month

NEWSPAPER men, and telephone men, too, will not soon forget the series of dramatic events which jammed the calendar from February 15 to March 12, 1933. Beginning with the former date, which marked an assassin's attempt on the life of the President-elect, Bell System services figured almost constantly in news dispatches for four weeks. In quick succession came such major happenings as the inaugural, a national bank holiday, Mayor Cermak's death, an earthquake and President Roosevelt's radio address on banking at the end of seven days in office—seven days which made history at a breathless tempo.

* * *

Scanning press reports as they came along through that history-making fortnight one gained the conviction that no dreamer could have conceived a more swiftly moving, more varied series of tests by which to evaluate the telephone and its associated functions as servants of humankind.

Bullets spouted from an assassin's revolver at Miami and the smoke had scarcely cleared away before reporters were rushing for telephones and calling "long distance" to speed verbal accounts of the scene to news distributing centers at Washington, New York and elsewhere.

Within a few minutes the communications office at the White House burst into jangling activity as newsgatherers all at once poured in reports by telephone. Meanwhile, press wires were flashing the story and its sidelights to the farthest corners of the nation. In this instance, as a paraphrase, "shots heard round the world" comes nearer being literally true than was the case in the famous poem.

A little later Mrs. Roosevelt telephoned her husband from

their New York City home and received his calm reassurance. Still following press reports, we are told that a Philadelphia friend of the Roosevelt family heard the news during a long distance conversation to Pittsburgh, and immediately hung up to put through a call to Mrs. Roosevelt for first-hand information.

Other uses of long distance pass in quick review: Dr. Joel T. Boone, physician of President Hoover, called from Washington and found the President-elect at the hospital with Mayor Cermak and the four other victims; President Hoover constantly was kept advised of their condition; Secret Service operatives questioned the assassin and telephoned the results to their Chief at Washington. Two days after the shooting, as Mr. Roosevelt's special train proceeded northward to Washington, a telephone was put aboard at every stop while the President-elect personally obtained reports from the Miami hospital.

Chicago doctors held a telephone consultation with Miami physicians concerning the stricken Mayor. . . . And after nineteen days his secretary turned from a telephone in Chicago to break the news to assembled friends: "Tony is dead."

* * *

This depressing news broke over the country at one of the most critical times in our national history, resulting from a series of bank holidays declared by various States in rapid succession. This phase of the now-familiar depression had begun in Michigan on February 14.

Again we find the telephone industry prominently in the picture. Behind the scenes traffic charts indicated that something unusual was happening. On the day that the Michigan banks closed, the number of long distance messages doubled in the Detroit office. The same was true at Cleveland on February 27. For the period from February 14 to March 13 (when the national banking holiday was partially lifted) long distance traffic figures, averaged for fourteen large cities,

crazily bounced up and down as conditions changed from day to day. On some days traffic was below normal while at other times the daily figures showed increases up to 15 per cent. Over the first week-end in March, traffic fluctuated widely from its usual limits, varying from 15 per cent above normal to 15 per cent below.

During this time, approximately 1,200 additional circuits were put into service by the Long Lines Department of the American Telephone and Telegraph Company. Overseas traffic figures also were affected in a startling way. The heaviest day for transatlantic telephoning was Saturday, March 4, which showed 91 calls. With South America, Bermuda and Ship-to-Shore services added to those overseas, the maximum day's business showed 116 calls. Total radio-telephone business during the bank holiday period reflected a world-wide interest in the financial troubles of the United States.

The details of conversation and telegraph messages exchanged by financiers and others during this momentous time must be left to conjecture. Outward manifestations of action, however, are plentiful as we turn again to the news dispatches. In the dark hours of the night before inauguration, when State closures had become an avalanche, both the President and the President-elect, with their advisors, turned to long distance time and again, marshaling reconstructive forces over a country-wide front.

Next morning found a mounting feeling of apprehension among the thousands of visitors in Washington. Most of them discovered that funds in their home States were tied up and that checks were practically non-negotiable in the capital. Thus, the man in the street, as had those in high places the night before, turned to long distance. Across the miles in every direction went spoken appeals for cash.

Many State Governors, in Washington for the inauguration and remaining for a conference with the new President two days later, frequently talked with their lieutenants at home.

To distant State officials Treasury experts gave verbal rulings, instructions or information concerning scrip.

* * *

Since the banking troubles overlapped inauguration activities, Bell System services and personnel obviously could not function in a single-minded fashion. Both of these major operations had to be carried on at the same time. But the fact remains that the inaugural assignment was a man-sized one by itself. The system of circuits set up for the National Broadcasting Company and Columbia Broadcasting System chains was more elaborate than for any previous inauguration. While nothing fundamentally new was done, there was a closer approach to perfection in circuits and other communication facilities than any other inaugural enjoyed.

Counting the facilities provided in America and in Europe it is estimated that 100,000,000 radio listeners were able to tune in on the proceedings. The program was carried over 35,000 circuit miles of wire to 175 stations in this country, and was re-broadcast in England and Germany.

More long distance calls were handled than on any previous day in Washington's history. The volume of traffic had been mounting for three days previously, as may be gathered from the fact that the long distance traffic of March 1 was greater than on Christmas Eve.

The normal group of 191 Long Lines circuits out of Washington was increased to 303 during the inauguration period. Included in the extra 112 circuits were 14 to Philadelphia, 26 to New York, 11 to Pittsburgh, 9 to Richmond and 7 to Chicago.

* * *

For all its swiftly-paced drama and tense excitement the period just reviewed was hardly more than a prologue. Immediately after the inauguration, President Roosevelt became the central figure in a political drama which redoubled the courage and lifted the hearts of a people: night-long confer-

ences by State and Federal officials; Presidential proclamations and messages with a wartime crackle; Congressional action at record speed. Through it all, communication services were instantly recording each move in detail for a nation which seemed suddenly drawn together in a community of spirit.

This was the moment selected by Nature to inject the Southern California earthquake—a crashing entrance upon a stage already crowded.

Again the telephone took the cue from hundreds of frantic relatives, friends and others interested in the fate of the stricken area. The disaster occurred late in the afternoon on Friday March 10. Between midnight and 5 A.M., 128 calls were reported from New York to California. All these calls were cleared by 7 A.M. Meanwhile, 91 others had been filed. The delays experienced were not due to lack of facilities so much as to the difficulty of locating those who were being called.

From midnight after the quake began, to 6 P.M. of the following day (Sunday) 1,042 long distance calls went through New York switchboards to Long Beach and Los Angeles. More than 900 of the calls originated in New York, while the rest came from European cities, with two calls from newspapers in South Africa and Australia respectively.

The normal outward toll board traffic from Los Angeles amounts to about 11,500 calls. Contrasted to this there were 31,000 on Saturday following the earthquake. Segregating Long Lines circuits from the local company toll lines we have a normal average of 280 calls per day out of Los Angeles. This figure rose to 1,900 for the day following the upheaval.

Normal Long Lines circuits serving Los Angeles number about 45, but 30 more were speedily set up to handle the emergency business.

Once more we are indebted to press reports for indications that the telephone always is prepared to live up to its purpose of serving anyone, anytime, anywhere, and do it quickly. Two

telephones in the White House, one of them handled by Mrs. Roosevelt, kept the President in direct touch with the situation. In New York, former President Hoover talked with members of his family to learn of their safety.

The London *Evening Standard* carried a graphic account of a telephone interview with someone in the quake zone while the tremors still were in progress. Other news dispatches record long distance conversations carried on in the midst of the catastrophe. For example, Walter Winchell, writing in the New York *Daily Mirror,* lets us listen in as he calls his wife:

"Are you all right?" she was asked by her worried husband.

"Yes, but it frightens me a little," came the reply. And then, after a few more words:

"What's the matter?" Mr. Winchell yelled.

"It's shaking again—right now," his wife shouted, "wait till I hold the baby's hand! . . ."

Because it touches a telephone tradition we may pause long enough to quote one more news report. A woman called the news department of *The New York Times.*

"You might be interested," she said, "in knowing that I have just tried to communicate with Los Angeles by telephone. When I had made connection with the Los Angeles operator the girl's voice, calm and unhurried, came over the wire:

"Sorry; I cannot connect you. We're having an earthquake."

* * *

On this calm note we may shift the scene back to Washington just in time to learn that President Roosevelt wishes to speak personally to the nation's citizens by radio in explanation of the fast moving events of his first week in office. And on Sunday night, March 12, the modern communications art put the President within ear-shot of millions of his fellow Americans. Normal facilities of the broadcasting companies were

used, 175 stations being connected by 35,000 circuit miles of Bell System wire.

The President's address was a fitting close to the thrill-packed month just reviewed. Within that space of four weeks human qualities of patience, courage and citizenship mobilized themselves in the face of adversity, and seemed to gather in more solid ranks against each new challenge. Several commentators sensed a new neighborliness among Americans. As always, danger and calamity provided the cause for this unity of thought and spirit. It seems equally true that the communications art furnished the means by which a widely scattered people were able to face common problems and perils with a new accent on the "we."

Undoubtedly, new history has been in the making. But from the telephone standpoint it was history repeating itself, under a new set of circumstances. It is evident that mankind in doubt and distress once more found Bell System facilities and personnel ready with the aid that perhaps was needed most—the swift interchange of thought and information which rallies confidence in an emergency as ably as it normally ministers to the social and business needs of the nation.

H. D. HOCKER

A New Service for Business Establishments and the Household

THE Bell System has made available a new service arrangement which is particularly well adapted to the telephone needs of moderate size business establishments and households where a number of telephones can be used to advantage. This new service does not require a switchboard or an attendant to handle the connections. These connections are all under the control of the user of each of the telephones by means of keys located in the base of the compact and attractive hand set telephones provided with the service. The keys are easy to operate and their functions simple to understand.

The new service provides for either one or two outside, or central office lines and as many as eleven telephones may be provided. The features of the service may be briefly described as follows:

Each telephone may make or receive outside calls.

Likewise, each telephone may make inside (intercommunicating) calls to or receive such calls from all the other stations on the premises; also, signal by buzzer to all other stations.

When one station is connected to a central office line all other stations are locked out, thus ensuring privacy and freedom from interruption.

Incoming calls may be answered at any telephone and transferred to another telephone on the premises, as desired.

One or two conversations over the central office lines and one conversation with another station on the premises can take place simultaneously.

The compactness and good appearance of the telephones and their associated control keys, together with such features as

quick intercommunication and the arrangement for ensuring privacy and freedom from interruption on outside calls, make the new service attractive to both business and family groups.

Use in Business Establishments

Figure 1 pictures a typical business group for whom the new service would be appropriate. Such a group might, of course, comprise either a distinct business establishment of moderate size or a number of people associated in a department of a somewhat larger organization.

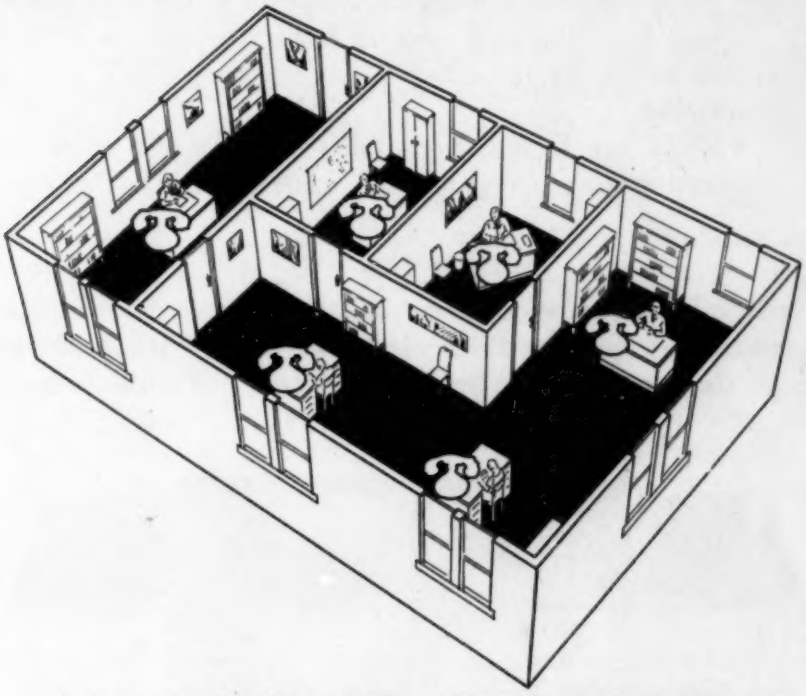

Figure 1. The New Service as Used in the Business Establishment.

In an installation of this kind several features are particularly valuable, such as:

From any of the telephones outside calls can be made or received without the aid of a special attendant.

Each telephone station can intercommunicate directly with any of the others in the office by simply depressing the proper keys.

All other telephones are automatically locked out when an outside line is picked up to make or receive a call, thus providing privacy.

One or more telephones can be restricted to inside intercommunicating calls only, if desired, such as, for example, the telephones in the file or stock room.

If desired, all incoming calls can be answered from any one telephone, such as from the telephone in the outer office.

These incoming calls can be transferred to the proper person at any of the other telephones having key control equipment.

Visitors can be announced directly over the intercommunicating line to any person in the office having a telephone.

In the Household

A typical installation of the new service in a household is pictured in Figure 2 which indicates key control telephones at convenient locations in a detached residence. The advantages

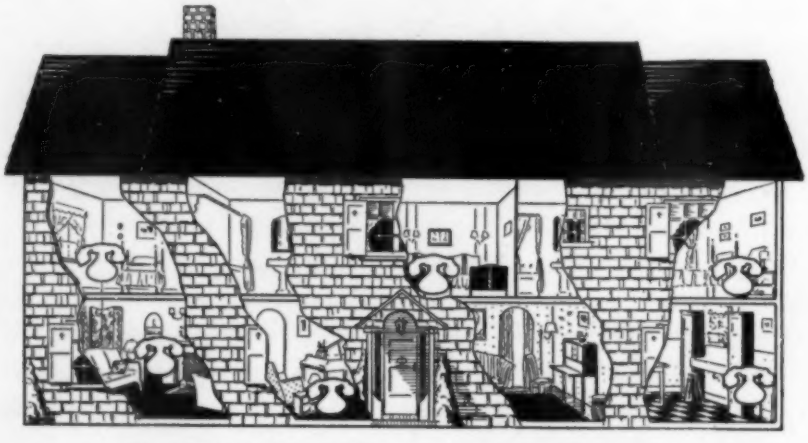

Figure 2. The New Service as Used in the Household.

of the new service from a household standpoint as outlined below would, of course, apply to apartments with corresponding telephone needs.

From the telephone in the bedroom, orders may be given directly to the servants in the kitchen. Likewise, incoming calls may be received or outside calls made with a maximum of convenience.

It helps greatly to simplify the planning of the whole day's program. Saves time and steps and results in a quiet, smooth-running household.

From the kitchen or pantry telephone the interconnecting line makes it easy to check the menu for the day and orders for supplies with the mistress of the household.

The orders may then be given promptly to the tradesmen over the outside line from the same telephone.

From the telephones in the living room and sun parlor, friends may be visited, appointments arranged, and business transacted quickly and comfortably with the assurance that no one can listen in from any other telephone in the house.

From these same telephones, by simply depressing a key, servants can be directed without moving from one's chair.

The guest room telephone is quiet evidence of a modern, well-ordered household. Guests will appreciate the provision of a telephone for their own use.

Operation

A closer conception of the details of operation of this service may be of interest and the principal features, involving the telephone itself, are illustrated in Figure 3. The five keys are marked from left to right, 1, 2, H, L, B, and are used to establish a connection with either one or two central office lines, to hold an outside call while it is being transferred, to connect to the intercommunicating line and to signal other stations.

Incoming calls are signaled by bells—those on the two out-

side lines being arranged to give different tones to indicate which line is calling. To answer an incoming call one lifts the hand set and presses key 1 or 2, depending on which line is being used, and then talks. Should the call be for someone who can answer more conveniently at some other station, key

1
CONNECTS THE TELEPHONE WITH AN OUTSIDE LINE TO MAKE OR RECEIVE A CALL
2
CONNECTS THE TELEPHONE WITH A SECOND OUTSIDE LINE TO MAKE OR RECEIVE A CALL
H
HOLDS A CALL ON AN OUTSIDE LINE WHILE MAKING OR RECEIVING A CALL ON ANOTHER LINE
L
CONNECTS THE TELEPHONE WITH INSIDE LINE TO MAKE OR RECEIVE AN INTERCOMMUNICATING CALL
B
OPERATES BUZZERS TO SIGNAL OTHER STATIONS ON THE PREMISES

FIGURE 3. HOW KEY CONTROL EQUIPMENT OPERATES.

H is pressed to hold the call, then key L is pressed to connect to the intercommunicating line, and key B is pressed to signal the person or station wanted. Code signaling is usually employed for this purpose. The person at the other station may first answer on the intercommunicating line and the person at the calling line station advises that there is a call waiting on

line 1 or 2. The second station then goes in on the designated line by pressing the key associated with that line and the first station then hangs up, thus making his station available for other calls.

As an optional feature, a small attractive lamp placed near the telephone may be employed to indicate a busy outside line. For example, if a person should press key 1 to make a call and line 1 was busy, the lamp would light, and he would then place his call on line 2. A single lamp is employed for indicating a busy condition on both lines, associating itself automatically with the line corresponding to the button pushed.

The relays and other equipment required for the switching features controlled by the keys in the telephones are contained in two small wooden cabinets having mahogany-walnut finish. These cabinets can, of course, be placed in an out-of-the-way location.

The new service described in this article is provided by what are known to telephone people as the "No. 15-A and No. 23-A Key Equipments." These equipments are of the same general type with respect to operation and station equipment as the 750-A Private Branch Exchange, but are arranged to meet the requirements of smaller installations and where the need for intercommunication is less. The 750-A Private Branch Exchange was described in the October 1930 BELL TELEPHONE QUARTERLY, in an article entitled "An Intercommunicating System for Homes and Offices."

C. J. DAVIDSON

Lightning

Editor's Note:

Storms and storm damage have been frequently described in the BELL TELEPHONE QUARTERLY *but always from the standpoint of the emergency created and of the accomplishments of the telephone forces in restoring the service for public use. The following article discusses storms and storm phenomena from another point of view, that of cause instead of effect. Though necessarily technical in character, it will be of interest to non-technical readers as evidence of the continuing study of storms in the Bell System and their effect on telephone service.*

INTRODUCTORY

BECAUSE of its magnificence and grandeur, lightning with its sudden and uncontrollable outbursts of power has always been an object of admiration as well as awe. No wonder that in the ancient days, when the gods were associated with visible objects such as land, sea, trees, and the heavenly bodies, lightning was supposed to be the special weapon of mighty Jove himself. Even up to modern times, lightning was widely regarded as a sign of divine displeasure and attempts to escape its baneful effects were decreed sacrilegious.

While lightning is no longer regarded as anything but a natural phenomenon governed by the immutable laws of physics, still because it is mysterious in character and unique in aspect while yet directly related to our daily life, lightning is a subject of widespread interest and even curiosity. To telephone people lightning presents a practical problem, for it is capable of producing serious effects on communication service, either by damaging overhead lines and their connected equipment or by disturbing the transmitted signals.

Geographical Variation

Lightning occurs all over the world, both on land and sea, but its distribution is very non-uniform. In the United States some regions have a hundred times as many thunder storms as others, the area of most frequent occurrence centering around northwestern Florida where there are on the average about ninety thunder storms per year. Severe lightning is also experienced in the northern New Mexico and southern Colorado area where the average number of thunder storms per year is about seventy. In the vicinity of New York City the yearly average is about thirty, while around San Francisco it is only one. Lightning is much more severe in some thunder storms than in others, but nothing indicates that on the average the storms occurring in different localities differ much in severity.

Development of Protection

If Benjamin Franklin had never done anything else, he would have immortalized his name by his famous kite experiment of July 4, 1752, by which he showed that lightning is electrical in character. At that time electricity was known only in its static form, it being forty-four years later when electric current was first produced from batteries and seventy-nine years later when the principles underlying the production of currents from inductive mechanisms were experimentally demonstrated.

Up to the latter part of the nineteenth century investigations in this field were concerned chiefly with the problem of protecting buildings by lightning rods according to the method proposed by Franklin. Since that time lightning investigations have been largely from the standpoint of developing protection for electric power and communication systems. The storage in large quantities of oil, gas, and explosives has also brought about special and difficult problems in lightning protection.

Modern Investigations and their Results

Lightning studies in recent years have made use of a number of devices and methods unknown to earlier investigators. One such instance is the simulation of actual lightning by controlled electric discharges at from one million to ten million volts. In the laboratory this method has yielded valuable information about the formation and behavior of long arcs in air. It has also been employed for test purposes on high voltage transmission lines. However, as the controlled discharges are necessarily on a reduced dimensional scale, care has to be exercised in applying the results to natural lightning conditions.

An instrument called the "klydonograph" has been extensively used, because of its simplicity, for securing figures of lightning surge voltages which indicate the magnitude, but not the duration, of the surge. Specimen records obtained by this instrument are shown in Figures 1 and 2. The magnitude of the voltage is indicated by the size of the light spot and the aspect of the figure tells whether the voltage was positive or negative.

Until recently, there has been no way to measure the time which a surge of lightning voltage takes to grow from zero to its maximum value, or the time required for the surge to disappear. In more technical terms, the steepness of wave front of the lightning surge, and the length and shape of its tail, were not definitely known. The cathode ray oscillograph has now been developed to a point where it can be used to record the changes in the lightning voltage during the period of the surge. Figure 3 shows a typical lightning voltage curve, as derived from records obtained by this instrument.

The magnitude of current in a lightning stroke has heretofore been unknown except by rough estimates of doubtful reliability. An instrument called a "surge-crest ammeter" has recently been devised which, it is hoped, will enable dependable measurements of lightning current to be made. Another recent device is the "storm severity meter" which

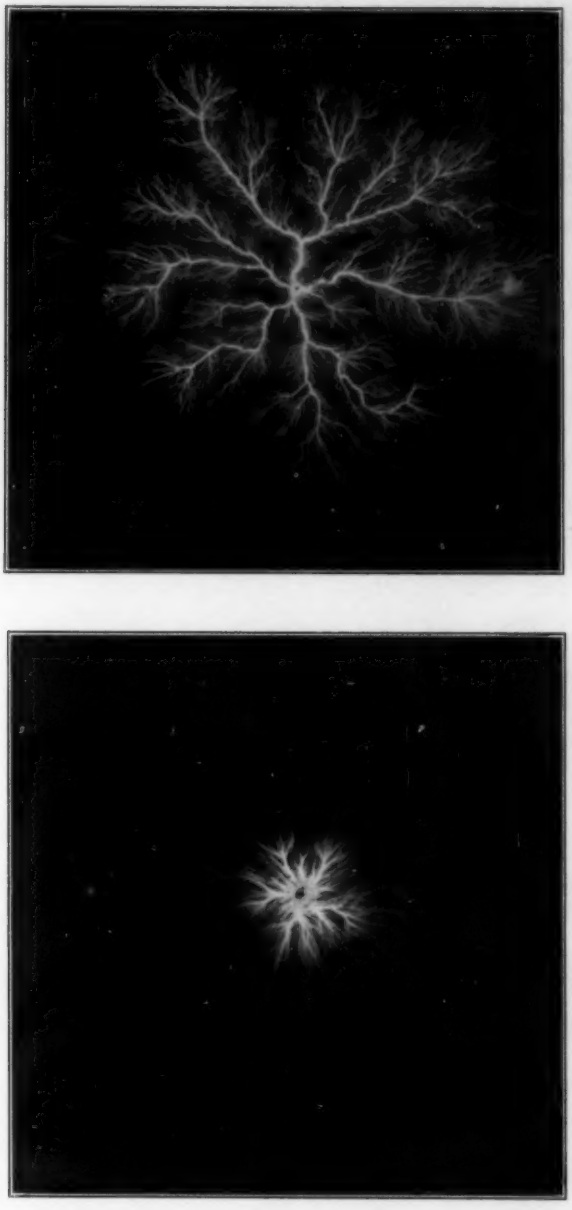

FIGURE 1. POSITIVE KLYDONOGRAPH FIGURES.

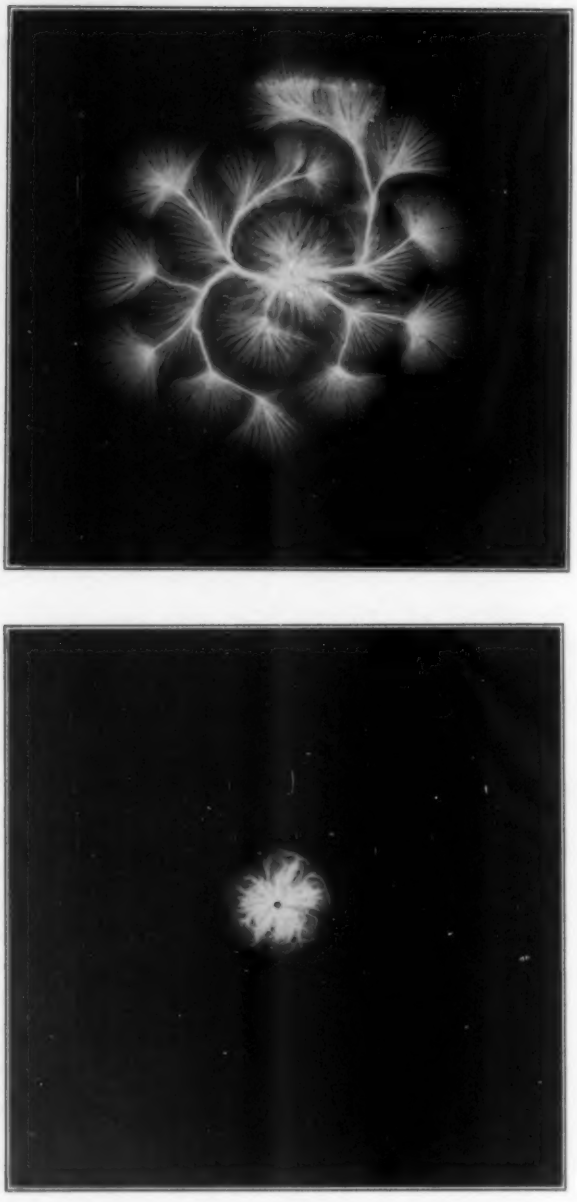

FIGURE 2. NEGATIVE KLYDONOGRAPH FIGURES.

makes a sort of integrated record of lightning intensity, through successive short intervals of time.

During the last decade there has been much intensive re-

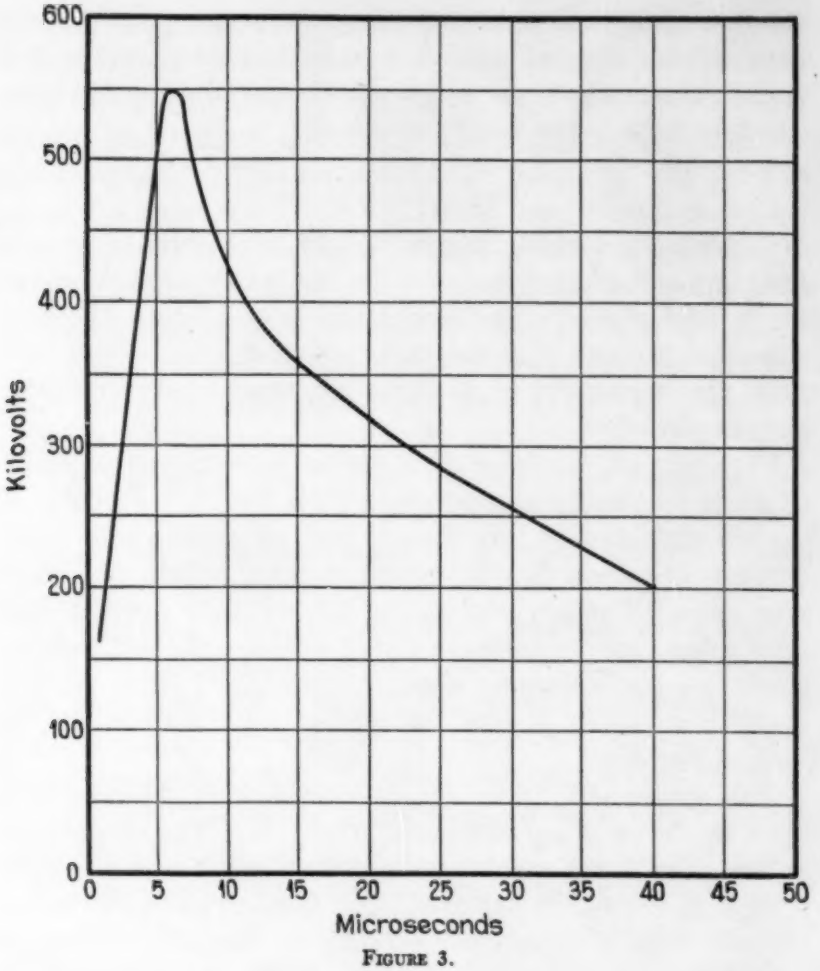

FIGURE 3.

search on lightning and it might be supposed that the subject is now well understood, but this is not the case. To say, paraphrasing Professor Shapley's quip on "Corpuscles," that knowledge concerning lightning has grown so rapidly in recent

years that now we know practically nothing about it, would be going too far. While there is no other electrical phenomenon of the magnitude and character involved in lightning, by experience with which we may be guided, still, by compounding the results of field tests and laboratory experiments, direct observations, fragments of fact, a little theory, and a few modest assumptions, we arrive at a conception of lightning which perhaps is not wholly erroneous.

The Atmosphere

Lightning is a spectacular actor and the theatre of its performance is the lower portion of the earth's atmosphere, called the "troposphere." The atmosphere is a mixture of gases, a tenuous expanse of atoms, molecules, and other minute particles, darting rapidly in all directions, now and then colliding with one another.

Pure, dry air, at the earth's surface is composed of about 78 parts by volume of nitrogen, a little less than 21 parts of oxygen and slightly less than 1 part of argon, with small amounts of carbon dioxide, hydrogen, neon, helium, and other rare gases. The air, however, is not normally dry but contains water vapor in amount varying with climatic and weather conditions but averaging about 1.2 per cent. The air also contains ordinarily a small amount of solid material in the form of fine dust.

The atmospheric gases are prevented from diffusing into space by the earth's gravitational attraction. The air pressure at any point is the weight of the vertical column of air above it of unit cross-sectional area, and falls off with increasing altitude from a value corresponding to about 30 inches of mercury at sea level, to less than one-thousandth of 1 per cent of that value at an altitude of 100 miles. As water vapor and dry air do not have exactly the same weight, the barometric pressure is somewhat affected by the degree of humidity.

When the air becomes saturated, that is, when the limiting

amount of water vapor at the existing temperature, is reached, some of the vapor condenses into minute water droplets. These may coalesce and fall as rain or, if small enough, may remain suspended in the air. A cloud or fog is an aggregation of such suspended droplets.

Anyone who is afraid of lightning can find a region free from it by ascending vertically into the air about seven miles where he will find himself at the base of the region known as the "stratosphere." The composition of the air at this point is about the same as at sea level, except that there is no appreciable amount of water vapor. The pressure has decreased to about one-fifth of its sea level value and the temperature has fallen to about —65° F., about 17° F. drop per mile of altitude. If our timid friend should ascend still higher, he would find that while the pressure of course continues to decrease, the temperature remains substantially the same, —65° F. for he is in the isothermal belt. Since there is no moisture in this region, there can be no rain or snow. Thunderstorms and lightning are phenomena involving moisture and are limited to the lower atmosphere or troposphere.

In addition to the particles above mentioned, the earth's atmosphere contains important forms of energy. Light and heat are transmitted to us from the sun and stars by means of high frequency electromagnetic radiation. All rays which reach the earth proper, including the cosmic rays, must of course pass through the atmosphere, as must also radiation from the earth to outer space.

Electromagnetic rays are understood to consist of streams of minute corpuscles called "photons." Such rays pass freely through space at the velocity of light, but their motion is interfered with when they strike a material body or even a small particle like an atom, their impingement on such body or particle exerting a mechanical force. The pressure exerted upon the earth by solar radiation amounts to about 100,000

tons, which corresponds to about one ounce of repulsive force per 50,000 square yards of surface normal to the radiation.

Ionization

The formation of electric charges in clouds and the sudden dissipation of these charges which constitutes lightning, are intimately concerned with an electrical process known as "ionization." The term "ion" was invented a century ago by Faraday to designate one of the charged particles in an electrolytic cell, half of which are positive and travel in one direction, the other half negative and travel in the opposite direction, when current passes through the cell between its two electrodes. It is now known that the earth's atmosphere also contains ions and that under some conditions they are very abundant in certain regions. The smallest known ion is the "electron," which carries one elementary negative charge and may roughly be regarded as an "atom of electricity." A particle having its normal quota of electrons is electrically neutral but on losing an electron, it acquires a positive charge equal in magnitude to the negative charge of the electron.

Ions are produced in many different ways. They are found in solutions of metallic salts. They are shot out from the heated filaments of vacuum tubes such as are used in radio sets. They are emitted spontaneously in the atomic disintegration of radium and other radioactive elements. Streams of electrons expelled at high speed from the disintegrating atoms of radium constitute the so-called "beta rays." Radium also emits "alpha rays" which are streams of helium atoms positively charged, each atom lacking two electrons. A helium atom corresponds in mass to four hydrogen atoms and a hydrogen atom minus an electron constitutes a "proton," carrier of unit positive charge and smallest known positive ion, although 1,800 times as massive as the electron.[1]

[1] The discovery of a corpuscle having the same mass as the electron but with unit positive charge instead of negative, has recently been reported. If the existence of such a free positive corpuscle is confirmed by further investigation, it may be

Of the radiation from the sun which reaches the earth's outer atmosphere, it is estimated that about 1/3 is lost by scattering and reflection into space, 1/3 is absorbed in the atmosphere, mostly in the highly rarefied region of the outer atmosphere, and 1/3 reaches the earth proper, most, if not all of which is later reradiated. The absorption of radiation is one of the causes of ionization of the air. The impingement of cosmic rays, rays from radioactive substances, and solar rays, particularly rays in the ultraviolet range, upon molecules or atoms in the atmosphere, not only reacts on the rays but releases ions from the atoms. Also an ion moving at more than a certain critical speed, by colliding with an atom or molecule, may dislodge therefrom another ion. Ionization of the atmosphere is also produced by meteors which are continually bombarding the earth, but these are for the most part dissipated before they have penetrated far into the outer atmosphere. Also it has been found by laboratory tests that ionization is produced when drops of water are broken up by an air blast, electrons being liberated or taken up by the smaller particles while the larger droplets are left positively charged. This action, which apparently is a form of frictional electrification, is thought to play an important part in the production of electric charges in clouds.

Moisture in the air tends to collect around particles of dust and free ions have a tendency to attach themselves to the water droplets. It is believed that solar radiation, insofar as it is absorbed in the lower atmosphere, is mostly expended by charging particles of moisture. Under the influence of high electric potentials, free ions are capable of moving at enormous speeds, but when such an ion becomes attached to a relatively enormous water droplet to form a large ion, it loses much of its mobility. Since the electric conductivity of air depends

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called a "positron," and the present electron renamed "negatron," the significance of the word "electron" being changed to include either negative or positive free corpuscle.

upon the mobility of ions, moist air is less conductive than dry air. Similarly free electrons increase the conductivity of air more than free protons and small ions more than large ions, since the latter have less mobility.

Thus we visualize the lower atmospheric space as populated by corpuscular bodies or particles, some positive, some negative, but most of them, normally, neutral. The negatively charged particles include free electrons, small ions or clusters of atoms and molecules, and large ions, i.e., water droplets or other minute bodies, having an excess of electrons. The positively charged particles include free protons and small and large ions which are deficient in electrons.

There is an increase in electric potential with increasing altitude, the potential gradient diminishing with the altitude and also varying from time to time and from place to place, but averaging near the earth's surface about 30 volts per foot. Thus a mile in the air, the potential is ordinarily about 100,000 to 150,000 volts above earth potential. There results a gradual and continuous movement of ions up and down through the atmosphere, from and to the earth, the prevailing direction of ion movement being that corresponding to the loss of negative ions by the earth. This ion movement corresponds to a current to the earth of about 1,000 amperes average value which is compensated for by reverse transfer of ions by lightning, rain, convection, and other agencies.

Electric Condenser

In considering the formation of electric charges in clouds, it is useful to employ the concept of the electric condenser. Essentially a condenser consists of two conductors, e.g., a pair of parallel metal plates, separated from each other by insulating material, which may be air. These two conductors form the electrodes of the condenser, and if connected to a battery or direct-current generator, become charged, i.e., negative ions pass to one electrode and positive ions to the other. If the

condenser has only small capacity, the migration of a relatively small number of ions, or in other words, the formation of relatively small charges on the electrodes, will make the potential difference between the electrodes equal to the voltage of the source of supply, at which time the flow of ions, i.e., the current, will cease. With a given condenser the number of ions which must migrate before the condenser is fully charged, is proportional to the voltage impressed upon it. If, however, too much voltage is impressed on the condenser, the air-gap or insulation between the two electrodes will break down, and there will be for an instant a violent rush of ions forming a spark channel through the insulation at the point of breakdown. This rush of ions quickly dissipates the charges and brings the two electrodes to the same potential.

In analogous fashion a cloud may be considered as constituting one electrode of a condenser, the earth beneath constituting the other electrode, the intervening air being the insulating material between these electrodes, or the electrodes may consist of two clouds or of different portions of the same cloud. This last case would not be possible if a cloud were a continuous conducting body like a piece of metal, but being an agglomeration of discrete moisture particles, with relatively large air spaces between them, it is possible for one part of a cloud to take on an excess of negative ions while another part of the same cloud assumes a deficit of negative, or an excess of positive, ions, i.e., one part of the cloud becomes charged negatively, and another part positively.

Formation of Charges

We may now consider a theory as to how electric charges in clouds may originate.

The absorption of energy from the sun's rays in different parts of the troposphere is not uniform, but is affected by several factors, one of which is the degree of humidity. The humidity in the atmosphere varies in turn from point to point,

depending upon conditions as to precipitation and evaporation from water bodies. The absorption of heat from the sun by a given area on the earth's surface varies with the angular inclination of the sun's rays to the surface, the character of the surface, and with cloud and other atmospheric conditions. The radiation from the earth into the atmosphere is non-uniform because of variations in temperature and in surface conditions. For these various reasons there are at different points in the lower atmosphere, bodies of air of various sizes, shapes, temperatures, densities, and degrees of ionization. These bodies of air, acted upon by gravitational forces, are set in motion, resulting in the well-known phenomenon of winds. Winds at the earth's surface are predominantly in a horizontal direction, but it is important to note that in the cloud regions, air currents may have strong vertical components.

Thunder clouds are characteristically of the cumulus type, i.e., they resemble a pile of granular material. Their formation suggests strong local air currents directed vertically upward. Thunder storms commonly occur on hot, humid days. Vertical air currents mean that heated air masses near the earth are rising to the cooler upper regions. As lower temperatures are reached, particles of water condense from the water vapor. The water droplets so formed gradually coalesce until they become drops too big to be longer supported by the upward air current, when they start to fall. When the relative velocity of the falling water drops and the rising air current reaches about 25 or 30 feet per second, or whenever the drops encounter sudden gusts of wind, they become blown apart into fragments. The breaking up of the water drops produces, as already stated, positively charged moisture particles, and electrons either free or attached to the smaller water particles. The latter being lighter are carried upward by the rising air current and become attached to water droplets in the higher regions of the cloud. The heavier positive particles merge with water droplets in the lower portions of the cloud. Thus

the lower part of the cloud becomes charged positively, the upper part negatively.

When the lower part of a cloud becomes charged, a charge of opposite polarity is induced on the earth's surface directly below. (The term "earth" should be understood to include objects on the earth's surface even though they are normally insulated.) If the cloud charge is positive, the charge on the earth's surface directly below the cloud will be negative, as the positive charge on the cloud attracts negative ions from more remote parts of the earth.

Just as the application of voltage (difference of potential) to a condenser, produces a charge on each electrode of the condenser, so the existence of electric charges of opposite polarity on the electrodes of a condenser, means that there is a difference of potential between the electrodes. If, therefore, the lower part of a cloud is charged, and the earth's surface directly below the cloud is charged oppositely, there must be a difference of potential between the cloud and the earth. As a matter of fact the difference of potential between a thunder cloud and earth may be enormous. When such potential difference reaches a value higher than the intervening air can withstand, there is a breakdown of the insulating air and a lightning stroke occurs, which is nature's way of relieving the excessive stress.

If we should explore the potential variation along a vertical line between the bottom of a cloud and earth just prior to a lightning stroke, it would be found that the fall in potential through the air is not uniform. The gradient (potential drop per foot) would be found to have at some point, a value much greater than the average. Observations indicate that the maximum gradient usually occurs at some point in the lower fringes of the cloud, but this is not always the case. Also the more intense the ionization at any point along the path between cloud and earth, the less the potential gradient required to start breakdown. When the gradient at any point becomes

as much as about one million volts per foot (or less if the ionization is strong) a spark or streamer will be initiated, indicating incipient rupture of the air. This streamer, producing most intense local ionization as it advances, is the initial stage of a lightning stroke. It indicates a highly condensed stream of ions passing at enormous velocity through a narrow channel rendered incandescent by the heat generated. The course of the discharge is usually very irregular since it is determined by the distribution of ionization and gradients along various paths between the cloud charge and the earth charge. A stroke often divides into several branches, some of which may die out before reaching earth if the advancing ions meet a body of bound ions of opposite polarity or diffuse to form a space charge.

In the simplest case of a lightning stroke to earth, half of the excess positive ions in the cloud pass to earth through the lightning channel, and conversely, half of the excess negative ions causing the earth charge, pass to the cloud, thus restoring equilibrium at least momentarily. The first transfer of ions between cloud and earth, however, is usually not just sufficient to neutralize the charges, and a second or third transfer may follow, i.e., several discharges may occur in rapid succession through the same channel.

Myriads of separate water droplets in the cloud, have to give up individually their positive ions to the lightning channel, and likewise receive negative ions from the channel, a process which requires appreciable time. Thus due to the time required for discharge, assuming a given charge in the cloud-earth condenser, the current of the lightning stroke is smaller than it would be if conditions were such that the charges could be dissipated more quickly.

The foregoing attempts to picture roughly an ordinary cloud charge formation and dissipation, but it is not to be supposed that the actual event is always so simple. The turbulence of the atmospheric gases in thunder storms often results in

violent upheavals of the cloud masses, with charges of polarity opposite to that described, so that a lightning stroke may represent dissipation of a negative cloud charge and a positive earth charge. The evidence as to the relative frequency of occurrence of positive and negative strokes is incomplete. Reports of laboratory tests with high voltage discharges between a metal sphere as a positive terminal and a grounded metal plate as a negative terminal, state that the stroke was found to start as a single stem from the positive pole and usually to split into several branches before reaching the negative pole. Such a discharge bears a striking resemblance to natural lightning from cloud to earth, which usually starts from the cloud as a single stem and forms ramifications before reaching the earth. This is consistent with the view that lightning usually results from a positive charge on the cloud. Other investigations of the polarity of lightning indicate that, while positive discharges from cloud to earth are more numerous than negative discharges, the latter are generally more severe. With either polarity it is believed that the discharge is usually initiated in or near the cloud. In rare cases the branching is towards the cloud, which may indicate a stroke initiated at the earth, but this is mere speculation.

When lightning strikes from one part of a cloud to another part, or from one cloud to another, potentials to earth may be set up by induction. Also a discharge between cloud and earth, produces secondary effects in the vicinity by induction. It was formerly supposed that induced voltages were an important cause of damage by lightning, but now it is believed that most injurious effects are caused by direct strokes.

Wave Shape and Other Characteristics of Lightning

Lightning strokes do not represent currents changing direction back and forth, but are non-oscillatory in character. The reason they behave like very high frequency discharges is that the lightning surge has a very steep wave front. Records

of lightning surges by cathode ray oscillographs on power transmission lines show that the voltage rises to its maximum at the rate of from 10,000 to 15,000 kilovolts per microsecond (one millionth of a second). The voltage falls off much more slowly, requiring from 10 to 100 microseconds to decrease to half its maximum or crest value (see Figure 3). If it were possible to make a record of a lightning surge wave front, without allowing the recording arrangement itself to affect the surge, the wave front would doubtless be found to be even steeper than these curves indicate.

Photographs taken with a rotating camera show that a lightning surge, which to the visual observer appears as a single flash, is really a sequence of surges following one another at intervals of from 1 to 10 thousandths of a second.

The effectiveness of a grounding connection to a lightning arrester is not indicated by its resistance to direct current or low frequency alternating current, but depends on its surge impedance. These two quantities, surge impedance and resistance, may differ widely, the former being largely determined by factors which do not affect the latter. For example, a coil of insulated wire spread out on the ground may, by reason of its capacity to earth, have a low surge impedance and constitute a good grounding connection for lightning, although being useless as a grounding connection for such frequencies as are used for commercial purposes.

Energy of Lightning Stroke

During its brief duration, a lightning stroke develops enormous power. The potential of a typical stroke may be a hundred million volts and the current, 200,000 amperes, corresponding to perhaps twenty billion horsepower. If the duration of the surge is 50 microseconds, this would mean some 200 kwh. of energy. These figures are very rough and intended merely to indicate the order of magnitude. Fortunately an object struck by lightning receives only a small percentage of

the total energy of the stroke, most of the energy being dissipated in other parts of the lightning path.

Area Affected by a Stroke

The area affected by a single lightning stroke, or by a single ramification in case of a branched stroke, is not large. Inductive effects at distances of 100 feet or more from the lightning channel are seldom severe enough to cause damage. Sometimes however, over ledgy or other high resistance formations, lightning will plow along the surface of the ground for a considerable distance before the charges are dissipated.

Auroras and Terrestrial Magnetism

As auroras are also electrical manifestations in the atmosphere, it might be supposed that they have some relation to lightning. However, there is no apparent connection between the two phenomena. As stated above, lightning is confined to a zone within a few miles of the earth's surface, whereas the lowest parts of auroras are at an altitude of fifty miles or more. There is however, a very direct relation between auroras and earth currents and earth magnetism, indicating that the electrical influence, whatever it may be, of which the auroras high in the upper stratosphere are a visible manifestation, does penetrate the troposphere and doubtless affects it to some extent.

Methods of protection against lightning and the degree of success experienced in their practical application will be discussed in a later article.

Howard S. Warren

INDICATES TRANSPORT LINE EQUIPPED FOR TWO-WAY COMMUNICATION
INDICATES GROUND STATION FOR TWO-WAY COMMUNICATION
EQUIPPED WITH
Western Electric
RADIO

Communications and Commercial Aviation

ISOLATION. That is the impression that the passenger generally feels most vividly when, for the first time, he sits in a transport plane apparently suspended between earth and sky and watches fields and farms, rivers, roads and towns pass slowly beneath. In clear weather the sense of speed is almost wholly absent. With the roar of the engines ever in the background, the passenger knows that the plane is moving at perhaps a hundred and twenty miles an hour. He knows it, but he is not conscious of it. Rather, he views the scene spread out below him like a topographical map with the calm detachment of a visitor from another planet. He feels remote from mundane clamor, aloof, alone with the small group in the plane, cut off from the myriad voices of earthbound humanity.

Not so the pilot. For he or the co-pilot is in constant communication with the world below.

He glances at his clock. It is almost time for a call from the ground. He notes his altitude, position and weather conditions in preparation for the expected call. A moment more and, right on the dot, there comes a voice out of the empty air: "Cleveland to eighty-four ninety-three. Go ahead." And the pilot answers: "Eighty-four ninety-three to Cleveland. Position is 15 on the course. Altitude 3000. Ceiling unlimited. Visibility 10 miles. Go ahead." The Cleveland dispatcher repeats the message. It is a routine report which the pilot makes to his ground stations at regular intervals. He has received word from the ground station to proceed, very much as a railroad train passes from one signal block to another.

At stated intervals our pilot will be called again. In the meantime, over his long wave receiver he will get spoken reports from government weather broadcasting stations.

Over his two-way system he will hear reports from other planes and may under favorable conditions talk directly to them if desirable. And at any time he can call one or more ground stations.

Sometimes he does. A case of acute appendicitis developed on a transport plane some time ago. The stewardess did what she could to aid the afflicted passenger and the pilot called the airport at which he was about to land. An ambulance was summoned and arrangements made to receive the patient. The radio telephone in the plane proved its worth in that emergency, as the telephone in the home has so often done.

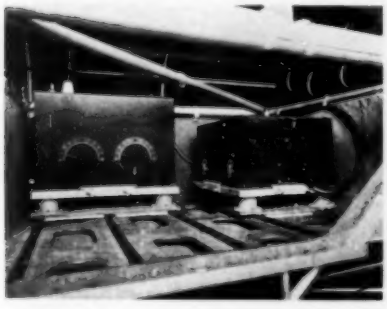
Or again, suppose a sudden fog develops somewhere along the line. The pilot of the plane in the affected area immediately calls his ground station and reports the condition. The dispatcher instructs the pilot to go around or over the bad spot or, if conditions warrant, he orders the plane to land at the nearest field. Along the charted airways regular or intermediate landing fields are never far away. Furthermore, the dispatcher calls the other planes in his territory which are approaching the fog area, warns them of conditions and issues suitable instructions.

This, then, is two-way aviation communication in action, a Bell System development which has added tremendously to the safety of air travel.

For the sake of clarity, the contributions which the art of communication has made to commercial aviation may be grouped under several heads. First, there is two-way high frequency radio telephone communication between airplanes and the ground. This may be subdivided into (*a*) air transport company two-way dispatching and (*b*) airport and itinerant flyer two-way communication. Second, government weather broadcasting and range beacon signals and their reception. Third, the use of the teletypewriter service by the Government primarily in making exact knowledge of weather conditions quickly available and in posting up-to-the-minute

THE TELETYPEWRITER BRINGS WEATHER REPORTS TO THE AVIATOR BEFORE HE LEAVES.

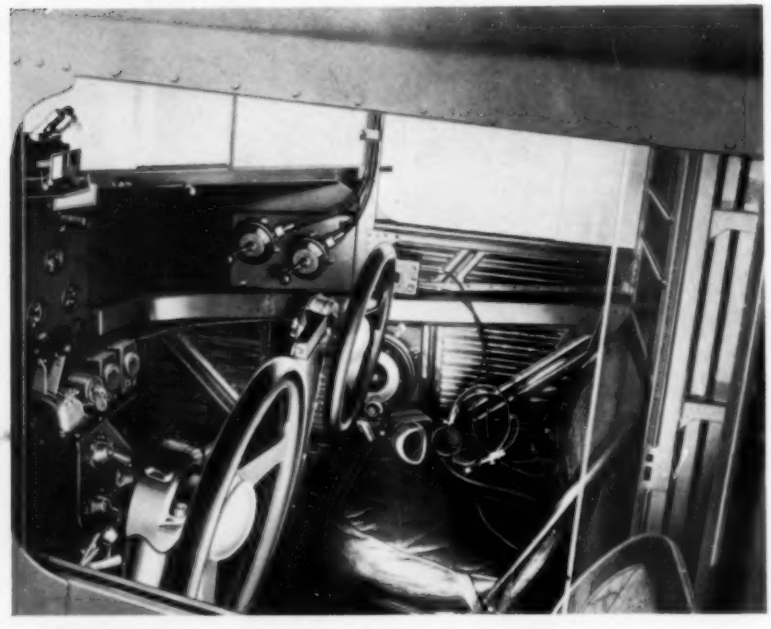
THE PILOT IN FLIGHT CAN TALK TO THE GROUND STATION.



RADIO-TELEPHONE EQUIPMENT FOR THE PRIVATE FLYER INSTALLED IN PLANE.

THE GROUND STATION CAN TALK TO THE PILOT IN FLIGHT.

FORD TRI-MOTOR AIRPLANE USED IN BELL TELEPHONE LABORATORIES EXPERIMENTS.



PILOT'S CABIN OF BELL LABORATORIES' FORD TRI-MOTOR AIRPLANE.

weather maps along an entire airway. Fourth, the use of teletypewriter service by air transport companies in connection with their operations.

It was in the spring of 1929 that the Western Electric Company and Bell Telephone Laboratories first demonstrated two-way radio telephone communication between airplane and ground for commercial air transport service. However, the Bell System's development work in this field dates back to World War days when the Western Electric Company turned out hundreds of airplane radio telephone sets. Experimental work was subsequently continued. About four years ago a five-seater monoplane was purchased by Bell Telephone Laboratories and later a trimotor plane of the transport type. In order to base the design of commercial radio telephone apparatus on a foundation of practical experience, test flights were made from Hadley Field, using the Laboratories' experimental transmitting station at Whippany, New Jersey. Other flights were made in California, using a transmitter at Oakland. Based upon these tests and upon continuous research combined with experience acquired through intimate contact with the aviation industry, designs were made and apparatus manufactured. Equipment embodying many fundamental improvements over the commercial units placed in service in 1929 was brought out in 1932. Many of the new sets are now in use. They will make for even greater reliability in operation than the earlier apparatus used by air transport companies during the previous three years.

To each air route a pair of frequencies are assigned; one of each pair in the 5 megacycle band for use by day, the other in the 3 megacycle band for night operation. Remote control quick shift gear permits rapid shifting from one frequency to the other by planes while in flight. To prevent interference, a schedule is set up so that each station will have exclusive use of the channels for a few minutes. By a glance at the special dial-face of his clock, the dispatcher can see when he may go

on the air to call planes in his vicinity. Plane transmitters operate, of course, on the same frequencies. When the pilot wishes to talk, he pushes a button mounted on his microphone which energizes his transmitter.

To override the plane noises a fairly loud signal must be delivered to the pilot's headphone. For this purpose the Bell Laboratories have developed a headset with a receiver using a special diaphragm which gives great protection against static crashes while not interfering with the desired signal. The pilot's headset is connected to both the two-way and the beacon receivers. The equipment is arranged so that the beacon receiver can be operated separately from the two-way communication system. This permits one pilot to listen to the range beacon while the other is listening to the ground station, or one or both pilots to listen to the receivers desired. Separate volume controls enable the pilot to listen to one receiver while having the other just above the threshold of audibility. Should a call come on the latter, a flip of the two control knobs will bring it in and soft-pedal the other, so to speak.

Keeping all these transmitters—in airplanes and ground stations—on their assigned frequencies is quite an accomplishment. If it depended on the stability of coils and condensers, as in the earlier broadcasting sets, communication would no doubt be handicapped by a deviation of several thousands cycles. To obviate that, all Western Electric transmitters are equipped with quartz-crystal oscillators. In each, a tiny slip of what looks like ground glass is adjusted and sealed into a holder. Its function is to hold the frequency of the transmitter within at least .025 per cent of what it is supposed to be. When a pilot's receiver has been tuned in at the starting point, it does not have to be tuned again during his run; and the dispatcher's set can receive from any plane in his division.

For the itinerant flyer the Western Electric Company manufactures apparatus that weighs only about 30 pounds

for the one-way equipment, or 65 pounds for the two-way system. Through co-operation with airplane builders, virtually all radio-equipped planes now have the units installed at the time of manufacture—an arrangement with obvious advantages from the standpoint of efficient operation, economy and appearance.

So much, then, for two-way communication. It is the most recent aviation communication development. Dovetailing with it are the Federal government weather broadcasting and range beacon services, augmented by teletypewriter wire systems.

The air navigation act of 1926 provided for the establishment by the Government of airways throughout the United States. The work has progressed rapidly and there are now 19,500 miles of lighted air-routes, equipped to furnish weather reports and range beacon signals. Through his long wave receiver, operating in the range of 230 to 500 kilocycles, the pilot may hear the rhythmic beat of the directional range signals. These signals form, as it were, an aerial pathway between beacons. So long as the pilot is on his course, he will hear a continuous tone, made up of a series of long dashes. If he should drift to one side, the accent of the directional signal would change. "Dot Dash" would be the sound. Or, if his drift were in the opposite direction, "Dash Dot, Dash Dot" would be the insistent warning conveyed through his headset. Along the established air routes the pilot is never out of earshot of this automatic transmission, which is interspersed with the identification signal of the station and is interrupted, periodically, by an oral announcement from the station giving an up-to-the-minute weather report. The radio receiver for such service must obviously be light, compact and rugged. Since it, like the other units, is operated by remote control, it is possible to locate it in an out-of-the-way place in the plane. Nevertheless, it may readily be removed from its mounting

base in a minute or so for inspection or repairs, or a spare set can quickly be substituted if desired.

Between the directional range beacons, the airways are dotted with brilliant lights which, several times a minute, alternate a flash of white with red flashes to identify their positions. These visual signals, like buoys along a water route, guide the pilot while he can see them. Yet, even when the weather is too thick to see the lights, the pilot knows his position from the directional signals which tell him what range beacon he is near—an important matter for the mail-plane pilots who fly in weather that keeps the passenger planes at the airport. Important, too, for a transport pilot caught in a sudden fog or squall.

But changes in weather conditions must be sudden indeed, to catch a transport pilot unaware. Before ever he leaves the airport at the start of a run, he examines last-minute weather reports from trained observers at points all along his route. Out of the teletype they come, clicking off on the tape the time, the point of origin and then a detailed systematic report, in standardized terms, of weather and wind, visibility and height of "ceiling" (as aviators call the lower side of the clouds). It is precise, exact, and conveys to the departing flyer full information as to present weather conditions all along his route. If he thinks them too unfavorable, he delays his start.

As these reports come in, the tape is cut off and pasted on a bulletin board, giving a complete picture of weather conditions. The picture changes as fast as the weather changes. Recently a further step has been taken: weather maps can be kept up-to-the-minute by teletypewriter. For this purpose, a machine is used that types with special characters on a page instead of a tape. A weather map is inserted in the sending and receiving instruments and a typist puts on it the symbols that indicate weather conditions at the points on the map on which he types them. They are reproduced exactly at all receiving stations on the circuit. A clerk draws in by hand

the lines connecting points of equal barometric pressure, technically known as isobars. Such maps, transmitted at three-hour intervals in sections and pasted together, present a graphic picture of the information verbally typed on the tape. Both come over the wires—leased circuits provided by the Bell System.

Over leased circuits, too, the teletype clicks its reports of the arrival and departure of planes, of the number of passengers and the amount of mail and express matter carried, of arrangements to be made. Every message can be sent simultaneously to all or any of the teletypewriter stations on the circuit. In addition, the nation-wide telephone network of the Bell System is used extensively in connection with air transport service. Emergency calls there are, also, though happily they are few. Last but not least, the pilot's periodical reports of his position are sent by teletype to stations further along his route, and they are warned to watch for and report him as he passes overhead. Isolated? Cut off from the world? Not a bit of it. The transport pilot is constantly in touch with the far-flung ground force whose mission it is to keep flying safe.

System, team-work, intelligent foresight and information as to weather conditions at the moment all along the line—these are the factors that safeguard air transport today. According to the Federal Radio Commission, there were, on January 1st, 1933, 231 ground radio stations devoted entirely to aviation. These include stations used as radio beacons or for two-way telephone service. Transport passenger planes in daily communication with the ground stations numbered over 300; and there were also a number of private planes equipped for such communication.

How rapidly this system of radio telephone communication for airplanes has grown is indicated by the amount of such equipment which has been furnished by the Western Electric Company in the first three and a half years that it has been

on the market. In 1929, 8 plane systems were furnished. In 1930 the air lines were supplied with 66 ground station systems and 52 plane installations. Twenty-nine more ground station systems were bought in 1931; and 117 additional planes were fitted with radio equipment. In 1932 the Western Electric Company supplied 20 ground station systems and 91 additional plane systems. In the aggregate, Western Electric radio equipment has been furnished for 115 ground stations and 268 planes in three and a half years. Not all of it is in continuous use, of course. Some is kept in reserve as spare plant by the air transport companies.

In the early days of aviation, newspaper writers used to refer to aviators as "birdmen." When we watch the great flocks of migratory birds fly to their Southern feeding grounds in the fall of the year and see them winging their way North again in the spring, we cannot but marvel at the instinct that guides their flight over hundreds or thousands of miles of land and sea. But when we see a great transport plane roaring through the sky at a hundred and twenty miles an hour, we know that not instinct alone but radio—not the least among many factors which contribute to safe flying—helps to guide and guard the pilot and his passengers every minute of their journey. If we are at all familiar with the history of electrical communication, we realize that the communication equipments which contribute much to the safety of air travel are developments that have been built upon the basis of Alexander Graham Bell's invention of the telephone. And these equipments are largely supplied by the organization that has developed Bell's invention into the nationwide telephone system that bears his name.

RICHARD STORRS COE
STERLING PATTERSON

The Telephone's Place in Co-operative Advertising

"What," asked the professor, "is the American industry which is most widely advertised?"

"The motor industry," replied one member of his economics class.

"No."

"Tobacco," said another confidently.

"No."

"Foods," a third guessed hopefully.

"Not at all."

"Electrical devices," a fourth suggested feebly.

"All wrong," said the professor, with the assurance of foreknowledge. "The most widely advertised industry in America is none of these. It is the telephone business. We have learned that we must look for three elements before we can determine that a commercial enterprise is readily susceptible to advertising. The first of these is a constant demand for the product. The second is a sales unit that is small in size. The third is some inherent power in the product itself to stimulate the habit of its use.

"In the telephone business we find all three elements very much in evidence. The demand is as constant as the human desire for communication. The sales unit is the telephone call—obviously small. And the telephone meets so universal a need that the habit of its use can be readily instilled and fostered by suggestion.

"Any business combining these elements might be expected to rank among our large advertisers. But in this case there is a fourth element that transcends the others while embracing them. I refer to the intimate relationship that the telephone

bears to the advertising done by other enterprises in every field of commercial activity. A vast army of merchandisers, selling everything from soap to automobiles, finds it advisable to suggest to its readers that the telephone be used in responding to its advertising.

"This practice of doing business by telephone I like to call 'telephone-merchandising.' And for those who are engaged in it I can think of no better term than 'telephone-merchants.'

"By means of telephone-merchandising the American people are daily, hourly, momentarily faced with the slogan, variously expressed, 'Use the telephone!' In the columns of the press, on the pages of the magazines, over the radio, by bill-board, direct-mail and word-of-mouth, thousands of telephone-merchants close their advertising messages with the reminder—'Our telephone number is thus and so—Call us.'

"And do the American people respond? They seem to. Twenty-five billion telephone calls are made by them in a year. That means a greater use than is made of all other forms of personal communication combined. For the number of first class letters is fifteen billion and the number of telegrams is less than a quarter of a billion.

"Now I have found you to be very practical-minded young men, and I can anticipate the question 'How many of these twenty-five billion telephone calls are the direct or indirect result of all this advertising?' Your guess is as good as mine. You may have the courage, but I doubt if you have the patience, to attempt such an estimate. But whether you guess at it or make a scientific study of it, you can start with the evidence of your common sense. It tells you very plainly that if all the telephone calls that are the result of present or past advertising were suddenly to disappear, not only would the telephone business suffer but our entire business mechanism would be thrown out of gear."

The Scope of Telephone-Merchandising

The Associated Companies of the Bell System have recently been giving much thought to what the professor calls "telephone-merchandising." Some have gone so far as to attempt such studies as he refers to. They have found that the volume of advertising being done by the telephone-merchants is so vast as to defy accurate measurement. From a series of test surveys, however, it is clear that not less than one-third of the local display advertising in the newspaper columns makes some reference to the telephone, if it be nothing more than to list the advertiser's telephone number. Of these advertisements about 10 per cent make a direct appeal to the reader to respond by telephone. A considerable number—telephone-merchants of the first water—build their advertising appeal around the advertiser's accessibility to the reader made possible by the fact that both have telephone facilities.

These surveys indicate the tremendous field which exists for aggressive telephone-merchandising. This great volume of telephone advertising is not half what it might be if the advertisers who are not telephone-minded could be made so and those who are already telephone-minded could be made more so.

Projecting the findings for the cities studied on a nation-wide basis, we may infer that telephone-merchants are paying not less than a quarter of a billion dollars a year for local newspaper display advertising that includes a telephone appeal. Projecting the findings still farther into the wide realm of advertising is something the author would rather leave to someone more statistically-minded.

The Merchandising Mind

Appreciation of the potentialities of the telephone in merchandising has contributed to the steady growth of the merchandising mind throughout the telephone industry during

the past three years. With the recent temporary decline in the public use of telephone service, the industry is becoming more than ever an aggregation of people who, in thought and in act, are merchants of telephone service whether they be engineers, accountants, lawyers or physicists.

It is recognized that our experience during the depression differs from that of other commercial organizations only in degree. To the extent that these other organizations find themselves affected by curtailment of demand, we may reasonably assume that they have also been developing the merchandising mind. This assumption appears to be supported by a casual examination of the advertising that Business America is doing at the present time. And there can be no better reflector of the mind of a business than its sales messages to its customers. Two characteristics seem to mark America's advertising of 1933, distinguishing it from that of 1928.

First, 1933 advertising seems to be more emphatic. More direct. More suggestive of a longing to sell. It seems to be a message from men more filled with a desire to show their prospective customers how the product is fitted to the public need. It seems to be written with an eye more on how the public wants to read it and less on how the advertiser wants to say it. In short, 1933 shows us advertising in a buyer's market.

The second characteristic of America's 1933 advertising is one that concerns the telephone business even more closely. Recent years have seen a marked trend toward co-operative advertising. Large industries having a common message for the public, or whose products are allied in the public use, are joining forces. We have seen for many years how such groups as fruit growers and paint manufacturers can pool their national advertising resources. But it has taken the dark days to make a gasoline company so farsighted as to base an advertising campaign on the slogan "Buy a new car."

Now it was just as true in 1928 that a man would not buy

gasoline until he had first bought an automobile. But there is something about the year 1933 that makes the truth more clear to all of us. It is as though there had been an awakening realization that we are all in the same boat; that nothing is to be gained by pulling against one another; that much may be attained by a concerted effort to row together.

In this trend toward co-operative advertising, it would be strange indeed if the telephone did not have a part, remembering the place it holds in advertising as reflected in the great volume of telephone-merchandising. As a matter of fact, two of the best examples of co-operation in the national field are the current Trade Mark Service and Long Distance campaigns of the American Telephone and Telegraph Company. Both, in their present co-operative form, were born during the dark days. They illustrate the 1933 trend. But more than that they illustrate how true it is that telephone advertising is as wide as advertising itself.

Trade Mark Service Advertising

The purpose of this campaign is to sell Trade Mark listings in classified telephone directories and thus to stimulate the use of the telephone in retail shopping. The appeal is to the national manufacturer. He spends thousands, perhaps millions, of dollars in nation-wide advertising. His return on this investment is in direct proportion to his ability to direct his readers to the dealers who carry his product. He can do this by listing these dealers under his trade name in the hundreds of classified directories that cover America, and by referring the readers of his advertising to these directories.

Thus do these manufacturers find that they can best advertise their wares by advertising the telephone too. A. T. & T. likewise finds that the best way to promote this Trade Mark Service, both with the manufacturers and with telephone users, is to feature in its advertising those who are already using it.

The photographed finger pointing to a Yellow Page listing of Kelvinator, Enna Jettick, Buick, Mimeograph and other nationally known advertising names is becoming familiar to the readers of America's magazines through A. T. & T. advertising campaigns. Equally familiar becomes the message of the manufacturers: "Find your local dealer in the classified telephone directory."

Long Distance "Case Advertising"

The purpose of this campaign is to promote the use of long distance telephone service by business organizations. It features specific instances in which telephone use has resulted in high sales at low cost, increased efficiency in administration, better service to customers, and decreased operating expenses. Not only is this campaign carried regularly in the national magazines, but Bell System newspaper advertising, which is under the direction of the Associated Companies in the field, has to some extent followed the same method.

The readers of telephone advertising have thus had placed before them advertisements which say just as much about the business of the Norge Corporation, the Hazel-Atlas Glass Company, the Proctor & Gamble Company, and scores of others, as they do about the telephone company and its service.

These companies in turn frequently apply these same advertising messages to their own use in carrying their own story to their customers. Sometimes they ask the telephone advertising people to prepare copy for them. Sometimes they distribute to their own customers folders adapted from telephone advertising—in fact hundreds of thousands of such folders were mailed in this way during 1932.

Thus when A. T. & T. mentions in its advertising the dispatching speed made possible to the General American Tank Car Corporation because of the telephone, this advertising message does not end there. The company thus advertised distributes to its own customers copies of the folder based on

CLASSIFIED TELEPHONE
"WHERE TO BUY IT"
The answer to
WHERE TO BUY IT?
"OUR NEW CAR HAS SAFETY GLASS . . . SO I'M ALL THROUGH WORRYING"
LIBBEY·OWENS·FORD SAFETY GLASS

Magazine Advertisements which Illustrate How A. T. and T. Co-operates with National Manufacturers in Promoting Trade Mark Service.

"We save money by using Long Distance"
SAYS THE PRESIDENT OF GENERAL AMERICAN TANK CAR CORPORATION
LONG DISTANCE RATES ARE LOW
SPEED
IN DISPATCHING TANK CARS BY TELEPHONE

Booklet of General American Tank Car Corporation and Magazine Advertisement of A. T. & T. Co-operatively Developed.

Phone Capitol 6666
The Charleston Gazette
"Want Ad Headquarters"
KITCHEN KLEENSER
and send 5 cans of Kitchen Kleenser and 3 Packages of AUTOMATIC SOAP FLAKES at once!"
Read's
Select your nearest Read's store and shop there for all your needs!
Do you know this Woman, Mr. Merchant?
If you know this woman, you know that the telephone has become a part of her very life.
If you know this woman, you will keep your telephone number ever before her, as a constant reminder that you are always at her elbow.
It will pay you to tell her, when you talk to her or advertise to her, how welcome she is when she comes to you by telephone.
The Chesapeake and Potomac Telephone Company
"Yes, we Guarantee our Dry Cleaning!"
Dry Cleaning Department
MANHATTAN LAUNDRY
HOME AGAIN
DECATUR 1400
100
DAIRY
Phone Orders Filled Promptly . . . Just Call Gilmor 6000
COLONIAL
ANTHRACITE
TELEPHONE NUMBERS YOU SHOULD KNOW
Phone Orders on WEAR-EVER Aluminum Specials to JANE STUART
NAtional 9800
LANSBURGH'S
Use Your Telephone
We Will Make Deliveries
UNITED FOOD STORES
BIGGER FOOD SPECIALS FOR FRIDAY and SATURDAY

TELEPHONE NEWSPAPER ADVERTISING DIRECTED TO MERCHANTS, AND EXAMPLES OF MERCHANTS' NEWSPAPER ADVERTISING SHOWING HOW UNIVERSAL IS THE FIELD FOR SUCH AN EFFORT.

this appeal. At the same time, another folder based on the advertising message is mailed out by Bell System sales forces in quantities running from 50,000 to 100,000 copies a month. The Bell System's advertising message is thus carried through this one channel to high executives in the fields of oil refining, chemicals, milk products, sugar refining, produce, paints and varnishes, lime and cement.

Working through the users of its service, the Bell System can get more out of its Long Distance advertising expenditure than it possibly could get working alone. Commenting on this subject, the Long Lines Department of A. T. & T. has this to say:

> This type of advertising has apparently carried more weight in all lines of business than the non-specific copy previously used, and it has definitely been helpful in strengthening relations with customers.
>
> An important outgrowth of the policy has been the development of an advertising service for many Long Lines customers and the coverage of a wider telephone market made possible by it. This has been accompanied by a corresponding enlargement of facilities for merchandising the magazine advertising.

Better Advertising Dollars

These two campaigns indicate very clearly that the Bell System is turning its attention to the development of its own advertising program in such a way that it will have a stimulating effect on the very much greater volume of telephone advertising that lies beyond its direct control. Co-operative advertising is particularly valuable to the telephone companies because their expenditures for advertising are not large when measured by the task to be accomplished.

Indeed, the Bell System's advertising program seems small when one considers the wide range of the markets and the media that it covers. It seems still smaller when measured against the gross revenues of the Bell System. It is actually much less proportionately than is spent by most of the large

corporations with which we are now joining in one way or another to get our combined advertising message into the public mind. The telephone advertising bill amounts to about one-half of one per cent of gross telephone revenues, while large corporations generally spend anywhere from 2 per cent to 20 per cent of their gross for this purpose.

Clearly then, the telephone advertising dollar carries a heavy load. There is no room for extravagance in administering it. It must be husbanded to the last penny, so that its full value may be brought to bear on the huge job of merchandising telephone service. Small wonder if Bell System advertising men look with pleasure on the trend toward programs that make possible the strengthening of their efforts by merging them with the efforts of allied advertisers for that greater productiveness that usually accompanies joint effort.

It is important to the telephone business to strengthen this bond of mutual helpfulness with these other businesses which are its allies. They are actually dealers in the service that we are furnishing and selling. The statisticians tell us that there are in the Bell System about 115,000 private branch exchanges through which originate or terminate about one-third of all Bell System calls. The welfare of telephone-merchants is our welfare. Their loss is ours. If they fail to distribute as many calls as the size and type of their business activity seems to indicate to us they might, it is a matter of great concern to us as merchandisers. If we were national manufacturers distributing a product much less salable than ours, we would not be satisfied until every available dealer was not only carrying our line but aggressively promoting it.

This principle was recently well expressed by the General Manager of one of the Bell System's operating areas. "It has long been our practice," said he, "to make exhaustive surveys of a customer's telephone needs so that his facilities may be adequate to the volume of calls that they will be called on to handle. To do this job properly, we have usually found it

necessary to study the customer's business in some detail. Our practices in this direction were developed to their highest efficiency when the great problem was how to handle an ever-increasing demand for our service that often taxed our best efforts to meet it. Now that our main problems have to do with getting all the new business we can, our attitude toward this large customer must undergo a change. We must approach him even more solicitously than before. Again we must study his business as intimately as our time and his patience will permit. But now we have a new reason for doing so. We want to show him how the telephone can fit more completely into his merchandising program. If by the use of our facilities we can help this customer to do more business and do it more economically, our business will benefit too."

Applying this principle to advertising, we find it well exemplified in the A. T. & T. national advertising above described. In these campaigns we see advertising filling its proper place as a function of merchandising. That is where we may expect increasingly to find it in the telephone business, side by side with sales and market analysis.

Approaching the merchandising problem from the viewpoint of advertising, telephone people find themselves confronted with a number of situations that call for the keenest kind of merchandising skill. Two of these revolve around the department store and the retail grocer, each an important outlet for telephone business. A consideration of them will serve to illustrate how wide, how universal and how important to the expansion of the telephone business co-operative advertising in the local community can be.

The Department Store

Most important in the list of telephone-merchants are the large retail stores in our big cities. It is not uncommon for them to have twenty, thirty, or even more sales people in constant attendance to handle telephone orders and inquiries, be-

sides making great use of the telephone for other purposes. The attitude of these dealers in telephone calls is an important factor in the volume of a telephone company's business.

How can we determine what that attitude is? The easiest way is to scan the leading evening newspaper in any city of reasonable size. If the reader wishes to try it, he will find the experiment interesting, and it will take not more than fifteen minutes of his time.

I have one such paper before me as I write. Let us scan it together.

The first department store ad appears on page 11. It makes no reference to the telephone, but displays the store's street address prominently.

The same is true of the second department store ad which appears on page 16.

Store No. 3 is advertised on page 28. In the top right hand corner is a forceful suggestion that the reader call the store's personal shopping service.

Store No. 4 is advertised on page 29. The telephone number appears in both top corners, with plenty of white space, and the statement twice repeated " Phone orders filled."

Page 30 is filled with the ad of Store No. 5, but no reference is made to the telephone.

In 18-point type across the bottom of page 33, Store No. 6 reminds its customers that " Phone orders are promptly filled," and the telephone number follows in the same type.

Store No. 7 on page 35 uses both street address and telephone number wherever its name appears.

On the following page the full page ad of Store No. 8 is quite devoid of either street address or telephone number.

The back page carries the ad of Store No. 9. It is obviously planned to appeal to the telephone shopper, and carries in large type the slogan " Call (telephone number) for phone orders—Direct phone to our shopping bureau."

Now the merchandising problems of these stores do not differ greatly. They have the same sort of market, the same kind of merchandise and charge much the same scale of prices. They operate in the same city, and if you had a blanket one

square mile in size you could throw it over all of them at one time. Moreover, six homes out of ten in that city have telephones, and ten thousand times a year the prospective customers of these nine stores ask "Information" for their telephone numbers.

How then can we account for such varied treatment of the telephone in the advertising which is the main link between these stores and their customers? Why is it that some seem indifferent to their telephone market, some seem almost to avoid it deliberately, while others aggressively seek to promote it?

The answer probably lies in the fact that to the department store the telephone is but one side of a many-sided business. And also that many minds, with many merchandising points of view, are brought to bear on the advertising policies of each store. These points of view, like the opinions of all of us, are based partly on experience and partly on inhibition. The practices based upon them are bound to be as varied as they seem to be in my newspaper and in yours. They will continue to be so until such time as the ideas behind them are formulated into a universal acceptance of the true place and proper use of the telephone in modern merchandising. The furthering of this formulating process is the biggest advertising job now confronting local telephone companies.

In the city in which the newspaper we have scanned appears, the telephone company is attempting to aid the formulating process by telling the readers of this same newspaper why they should shop by telephone. But it does so in a still small voice as compared with the thunderous tones in which the stores themselves talk to the shoppers. How much better if it can so direct its advertising effort as to get the stores' volume behind its telephone shopping message! This is in fact the philosophy that is now guiding telephone advertising in that city. The telephone merchandising policy of Store No. 9 above is a direct outcome of a co-operative advertising plan

between the company and the store. One week after the co-operative campaign was launched, additional facilities were being installed in the store to meet the increase in the volume of its telephone orders.

Most of us have a streak of laziness—or, if you will, a love of leisure. When we read an advertisement we may feel inclined to purchase the article described. But the physical effort of going to the store to get it, or even of looking up the store's telephone number, may be the difference between buying and not buying. The merchant whose telephone number is clearly displayed, and whose ad is prepared with the thought in mind that it will definitely win a telephone response, has a better chance of getting the order than the merchant who ignores the telephone entirely.

It seems obvious that, through its advertising and the efficient handling of the resulting telephone business, one large department store can do more to influence the shopping habits of the city's people than the telephone company can do directly. Multiply then that one store by all the other telephone-merchants whose advertising appears in that city's newspapers—particularly Stores Nos. 1, 2, 5 and 8—and it will be understood why the telephone company's own advertising is now being directed to the merchants as well as to the shoppers themselves. The appeal "Shop by Telephone" is being supplemented by copy that reads something like this:

Do you know this woman, Mr. Merchant? How fond she is of ease and comfort. How alive she is to new ideas—how quick to cast aside old ways. How keen she is to recognize bargains—how immediate her response to them. How ready she is to patronize those who do business in the way she likes to do it.

If you know this woman, you know that the telephone has become a part of her very life. If you know this woman, you will keep your telephone number ever before her, as a constant reminder that you are always at her elbow.

It will pay you to tell her, when you talk to her or advertise to her, how welcome she is when she comes to you by telephone.

—An American Paper for the American People—MONDAY, NOVEMBER 01, 1999
O.K. Washington!
LET'S CALL
DIstrict 9400
THE HECHT CO.'S
New Convenient Telephone
Shopping Service Number
DIstrict 9400 now connects you directly with our Telephone Shopping Service
No switching from person to person when you phone here. No longer is it necessary when making purchases in two different departments to be switched from the salesgirl in the first department to the operator and then to the salesgirl in the second department. Any one operator on DIstrict 9400 will take on as many orders as you wish to place in as many departments as are involved.
One Telephone Shopping Clerk Can Handle 4 Different Kinds of Transactions for You!
Call DIstrict 9400 and the first operator you speak to will take care of as many purchases as you wish to make; make any simple adjustment which you may find necessary to ask for; arrange for "calls for merchandise" which you may find necessary to return to The Hecht Co.; do any personal shopping you may not have the leisure to do yourself.
NAtional 5100
is still our regular telephone number for all other types of calls.
The Evening Call
WASHINGTON, D. C.
"Voice With a Smile" At Hecht's
THE HECHT COMPANY INSTALLS NEW TELE-
PHONE ORDER DEPARTMENT—DIstrict 9400
Let's Call DIstrict 9400

DEPARTMENT STORE NEWSPAPER ADVERTISEMENT AND TELEPHONE COMPANY'S BILL INSERT, CO-OPERATIVELY DEVELOPED.

Examples of Window Displays Developed Co-operatively with Various Types of Small Retail Stores.

Co-operative advertising with department stores has expressed itself in various ways in Bell System Associated Companies. Telephone advertising departments have prepared copy for store advertising and display material for store windows. Standard telephone illustrations have been distributed to the stores. In one case a company carried the story of a store's new shopping facilities in its monthly bill insert. This insert, with its accompanying telephone advertising, the store in turn distributed in the packages of its customers.

These are merely straws that show how the wind is blowing. Co-operative telephone advertising can be widely developed to the joint benefit of department stores and telephone companies. To the stores it gives promise of sales that are now being lost. To the companies it makes possible an increased use of the telephone by both seller and buyer.

The Retail Grocer

Another group of telephone-merchants having great influence over the volume of telephone calls is the retail grocers. Their merchandising methods differ greatly from those of the department stores, yet in one respect they resemble them. Their telephone-merchandising has not kept pace with the growth of the telephone habit among their customers.

This is a serious obstacle in the way of telephone expansion. Chain grocery store groups have a sales volume of about three billion dollars a year. Assuming that the average grocery order is less than three dollars, this sales volume involves more than a billion individual transactions calling for communication between buyer and seller. Thus when we talk about the chain grocery stores we are talking about a market for telephone calls whose maximum possible development is not far from 4 per cent of all the telephone traffic now being handled in the United States. Now these grocer groups for the most part advocate "no-telephone-and-no-delivery" policies. The advertising man who is endeavoring to sell housewives the

idea of "Shopping by Telephone" cannot be indifferent to a state of mind among the merchants themselves that works directly against the story his advertising tells.

A survey made in Baltimore a year ago developed the fact that 42 per cent of the housewives who have telephones would rather market by telephone than in person. From this it might seem that all, or practically all, grocery stores in that city do a substantial part of their business by telephone. But no. The fact is that out of 2,785 grocery stores in that same city, 804 have no telephones at all. And these are the larger stores for the most part, belonging to the chain groups.

The woman who markets in person goes through the same performance nearly every day, regardless of weather. She has to walk several blocks to the shopping section. Or she may back her thousand dollar automobile (costing ten cents a mile to operate) out of the garage and drive it to the store hoping to find a parking place nearby. She waits at the counter until a clerk is ready to serve her. Then she names the articles she wants and waits while the clerk assembles them one by one. In some stores she actually assembles them herself, cafeteria style. Most of these articles are so packaged or canned that she has no opportunity to examine the quality of her purchases. When a choice is desirable, the clerks quickly come to know her likes and dislikes. She returns home after consuming the best part of an hour in a task that could have been accomplished in five minutes by use of the telephone in her home.

What arguments have the non-telephoned grocers to present that induce the women of a large city to go through this rigorous task every day, *and like it?* The chief argument is that by saving the cost of a telephone-and-delivery system, they are able to shave the prices of their goods. Expressed in terms of an individual order, this cost could hardly be more than 5c. To save this amount the shopper spends the best part of an hour. It would be absurd to say that any grocer appraises the time of any housewife at 5c an hour—a mere fraction of

that paid regularly to common labor. Certainly the housewife would agree to no such appraisal. The truth probably is that neither the housewife nor the grocer has thought about the matter in this light.

The telephone business has too much at stake to be indifferent to a state of mind which does not appreciate the uses and advantages of the service it is selling. With increased thought given to their merchandising problem, we may reasonably expect to find telephone companies taking steps to change it. The first step would seem to be to sell the idea of telephone service to the grocers, adapting it as may be necessary to meet the grocers' needs. The second step would then be to join with the grocers, through co-operative advertising, to bring the desirability of telephone marketing to the attention of the grocers' customers. With at least two-thirds of the grocers, in most cities, already more than half convinced, this task does not seem to be an impossible one.

If a large wholesale grocer should find an increasing number of storekeepers indifferent to his line, his procedure would be simple enough. He would attempt to adjust his product to meet the wishes of these indifferent grocers. At the same time he would redouble his efforts to create a public demand for his product by helping the friendly stores to distribute it more widely.

There may be a parallel here for the telephone business. In Baltimore the telephone company has undertaken an experimental campaign in co-operation with telephone-merchandising grocers which indicated that there is. In the neighboring city of Washington, a co-operative advertising plan that cost the telephone company $600 was instrumental in chain store installations now bringing in revenue of $19,000 a year, besides making possible a step in the direction of fitting the telephone to the joint needs of the chains and their customers—a consummation devoutly to be wished.

These cities are mentioned here because they have come

within the writer's direct observation. Similar examples can undoubtedly be found in other cities, for the urge toward co-operative advertising to stimulate telephone business is not restricted to any particular area or company.

Conclusion

Important as telephone-merchandising is because of its effect on the telephone advertising program, it has a much broader significance than that.

A vitally important contribution that our generation should make to civilization is the development of a system of distribution that will make it possible for the people of the world to consume the output of their highly developed production system.

Advertising is the best means known to our generation to get this output before the wide-flung markets of the nation.

The telephone is the best means known to our generation whereby the buyer can quickly respond to the advertising message.

Advertising and the telephone can thus contribute materially to the solution of an important economic problem. In this fact there is a challenge—almost it amounts to an obligation—for these two forces to work together.

J. M. Shaw

Myths of Telephone History

EDITOR'S NOTE:

There have been as the years passed many stories told and repeated about the invention and development of the telephone which are not true. Some are entirely imaginative. They are still frequently referred to the librarian of the American Telephone Historical Collection for verification. His primary interest has been in reporting what the records show, but he has naturally also been interested in noting how far these stories have traveled away from the facts, and how it was that they have reached their present form and character. This article embodies what he has found,—in the various records, written and printed, documentary and legal,—in the historical library of the American Telephone and Telegraph Company to account for some of these myths.

HUMAN nature is idealistic. But much that is idealistic is not therefore ideal. Mankind is often chary of the facts, content to get along with a few of them instead of anxious for all of them. Even, or especially, in the immutable realm of the past, we are prone to feel that what we think ought to have been, was so. This is essentially the trouble with much written history. An imaginative statement once invented and promulgated, the present purposes and immediate interests of active life and business bring their pressure to bear in its favor. In this way are many myths born. For the rest, we glide care-free back through the past, seeing things indiscriminately, some of which like the Ichthyosaurus have come and gone through evolution, and some of more purely mythical character have come and stayed.

Among the best authenticated instances of telephone myths stands the pathetic figure of Joshua Coppersmith. Joshua had a clever father, whoever he was. The son is plausible in form, and he still wanders up and down the land, doing odd jobs filling space in worthy periodicals. Like other famous characters, his birthplace is variously credited,—to New York, to Boston, to "somewhere in the East." There is reason, it may be stated, to add to the list an enterprising town in the Middle West. Naturally no one of his editorial sponsors has thus far been able to cite for verification the name of the newspaper and the date on which the news of Joshua Coppersmith was first printed, but this it may be unreasonable to ask.

Whenever it was, the story goes that:

> A man about 46 years of age, giving the name of Joshua Coppersmith, has been arrested in New York for attempting to extort funds from ignorant and superstitious people by exhibiting a device which he says will convey the human voice any distance over metallic wires so that it will be heard by a listener at the other end. He calls the instrument a 'telephone' which is obviously intended to imitate the word 'telegraph' and win the confidence of those who know of the success of the latter instrument without understanding the principles upon which it is based. Well informed people know that it is impossible to transmit the human voice over wires as may be done with the dots and dashes and signals of the Morse Code, and that, were it possible to do so, the thing would be of no practical benefit.
>
> The authorities who apprehended this criminal are to be congratulated, and it is to be hoped that his punishment will be prompt and fitting that it may serve as an example to a horde of other conscienceless schemers who enrich themselves at the expense of their fellow creatures.

There are a number of little slips in this story to arouse suspicion. The offense charged is extortion, rather than swindling. But the man is said to have exhibited the device. Why then would not a simple demonstration have either confirmed the charge or justified the defendant? But the appeal is rather to the indefinite "well-informed." On analysis, as often proves to be the case, the real implication is against the Press and the Courts, the one for apprehending and the other for demand-

ing long imprisonment on a charge that any way you take it will not hold water. But alas, newspapers and periodicals still amuse themselves by harrassing the poor man, now long past a hundred years old, although there never was any such man. In all fairness and kindness old Joshua's ghost should be allowed to rest in peace.

Myths naturally grow in profusion around the hero. So has it always been; and so is it likewise in the case of the telephone.

One of the major myths of Alexander Graham Bell, and curiously one of the most popular, is that on more than one occasion he offered to sell telephone stock for ridiculously low prices, for $10 a share and even $1.00. One story declared that he offered a share of stock for a meal, because he was so poor. How rich this person's own father or grandfather would have been if he had only loosened up and accepted the offer, was a matter for simple computation. These tales all reflect of course on the acumen of those who refused the golden opportunity, but nonetheless these dreams of the might-have-been seem to be favorites with their sons and grandsons.

Now, what are the facts? Alexander Graham Bell was in no way interested, nor was he at all active in the business side of the development of the telephone. He was absorbed in the scientific side of the invention and in its human possibilities, what it could do for mankind,—for men and women and children in their daily lives. He never peddled stock; nothing could have induced him to do it. Nor was there any need for him to undertake it. In the hands of the wise Gardiner Greene Hubbard and the experienced Thomas Sanders, with Theodore N. Vail added in the summer of 1878, there was no need for Mr. Bell to try anything of the kind. He never sold a single share of stock for the company. As to his selling his own personal stock, he had only 10 shares in his own name in the early days. All the rest of his 30 per cent of the stock he gave to his bride as a wedding present.

The flower of the telephone stock myths is the one relating that at the Centennial Exhibition in Philadelphia in 1876 anyone could talk through the telephone for 25 cents and buy a share of stock for 4 cents. But there was no telephone stock at all at that time; not until August 1, 1877.

It would seem that there must have been some basis for these stories. How did they start? Those who relate them are mostly people of honesty and intelligence, entirely sincere. It may be there were some instances in which the stock was that issued by one of the local agents who were organizing telephone exchanges under licenses from the Bell Company. More likely it may have been the stock of one of the acoustic telephone companies, that put out the "lovers' telegraphs," the two-tin-cans-and-a-string playthings. Some of these instruments were quite practical for short distances. But the stock was not that of the Bell Telephone Company, or of either of its successors, the National Bell or the American Bell Telephone Company. The two men who certainly knew,—Thomas Sanders, the treasurer, and Charles Eustis Hubbard, the secretary,—both of them wrote signed statements that telephone stock was never sold for less than $50 a share; and those statements are now in the American Telephone Historical Collection. Telephone stock sold on the market for the first time in the summer of 1879,—for $110; and following the settlement of the so-called Western Union Case, it sold in December, 1879, for $995. In that whole price range no one was very scornful! Since then the prices of telephone stock have been a matter of record. So the whole history of telephone stock is covered from the date of the first issue to the present. It is easy after forty or fifty years for the memory to slip in the matter of dates by a year or two. Still more is it easy, indeed natural, if there be involved a distinction between different companies, or between two radically different kinds of apparatus, such as between the acoustic telephone which operated merely by physical impulse, and now long since

forgotten, and Alexander Graham Bell's telephone, which transmitted speech by means of electricity.

There have been two contradictory myths directly connected with the inventor of the telephone. They were closely related to each other; it may be the one sprang out of the other. The one avers that Bell's invention of the telephone was an offshoot of his work for the deaf, indeed that he invented the telephone to enable the deaf, especially his wife, to hear and to speak. Alexander Graham Bell was deeply interested in the education and the welfare of the deaf all his life; it was his chief interest and was central among all his many varied interests. As for the sentimental motive, there never was any occasion for him to invent anything of the kind for Mrs. Bell's benefit. She spoke very intelligibly and could read the lips of anyone with whom she was conversing readily before Mr. Bell ever met her, and she never was really in the proper sense of the term his pupil.

There is an essential distinction that many people ignore between those who are hard of hearing, even very hard of hearing, and those who are really deaf. Mrs. Bell was deaf, had become so through scarlet fever when a little child. So too Mr. Bell's five-year old pupil, George T. Sanders, was absolutely deaf, born deaf. The telephone could not possibly help either of them. The development of amplification and selectivity which have been accomplished by the Bell Telephone Laboratories in the Audiphone during the last ten years will greatly help those who are hard of hearing, but the telephone can do nothing for those who have no auditory nerve. Except that Bell in pursuing each of his varied lines of research always kept his mind alert for anything that might apply to any one of his other lines of work, Bell's work for the deaf did not lead to his invention of the telephone. Indeed, Bell got started in his work for the electrical transmission of speech several years before he became interested in the deaf.

The other myth connected with his work for the deaf is that

Alexander Graham Bell very soon turned against the telephone and would not even have one in his house. A tragically romantic eventuality! One of the gargoyle incidents of the history of science and of civilization! Alas for the sternness of truth that checks the throbbing tear! He discontinued his work on the telephone because he believed he had completed his part in the development and that others could do what had now to be done, whether technical or commercial, as well as he could or better. Also, and even more, as has been said, his chief interest was in his work for the deaf. He wanted to get back to that great human work. No, there was nothing morbid or abnormal about his attitude toward the telephone. He appreciated it, and heartily honored those who carried on his work, saying years later that he could hardly believe that he had ever had anything to do with this wonderful means of nation-wide communication.

There is in the American Telephone Historical Collection a contract dated April 1, 1881, and renewed in 1886, between Alexander Graham Bell and George C. Maynard, agent of the American Bell Telephone Company, calling for telephone lines between Dr. Bell's residence, his laboratory and the homes of his family and of relatives, with an additional telephone line to his laboratory, eight lines in all! And during the latter part of his life Dr. Bell had a telephone in every room of his house except his private study and the parlor. So, too, at his summer home on Prince Edward Island, he had a private telephone line six miles long going around the Bras d'Or Lake to Baddeck; he had three telephones in the house and a telephone in every building on the place,—even, for emergencies, at the little cabin deep in the woods where he used to go alone for uninterrupted thought. Far from turning against the telephone, no one could have shown a more practical appreciation of it than he, nor taken it more intimately into his daily life. The only fact that can have given rise to this myth is that

Dr. Bell did not want a telephone in his own private work room.

If anything under the sun be only big enough it is easy to subject it to attack. The Lilliputians appreciated this when they saw Mr. Gulliver and they forthwith proceeded to tie him up. Telephone history supplies for the convenience of mythology a similar giant, the telephone litigation of 1878–1893 et seq. Myths grow luxuriously in the rich soil of litigation. Any moderately attractive myth-germ can get started in it and have a fifty-fifty chance of coming through to wide acceptance, for as sure as one side wins, the other side loses. In the minds of the losers then it is incontrovertible that the decision was all wrong; that the court itself was, must have been, prejudiced (a suspicion never entertained until after the decision); and what could so clearly have been behind the wrong decision of a prejudiced court as—money? So the banner of the lost cause is raised over the battle ground and the soil is fertilized for any promising young myth that may hope to cut a figure in this cruel world. If perchance the court was conspicuously unanimous in its wrong decision, what proof could there be more positive of judicial subserviency to the will of the victorious litigant? And there you are.

Consider then the deplorable conditions in the telephone litigation, in which there was a tangled mass of no less than six hundred law suits, all of them decided in favor of Alexander Graham Bell as incontestably the actual and the first inventor of the telephone. So not a few vigorous little myths crawled from out the larva stage and the fostering care of interested parties and soon winged their way to the credulous belief of a sympathetic public.

Unfortunately a few hard facts are necessary to the full appreciation of this interesting phenomenon of the mythological lepidoptera and of the beauty of their flight. But these facts may be briefly presented. The six hundred lawsuits of the telephone litigation in regard to the validity of the Bell

patents may be divided into two parts. The first consists of one single case, the so-called Western Union Case; the other part consists of the remaining 599 cases. That first case had real merit. It presented to the court a real issue for decision: Did Bell merely invent an instrument, as the Western Union Telegraph Company contended,—in which case the Western Union's inventors, Elisha Gray, Amos E. Dolbear and a young man by the name of Thomas A. Edison who had invented telephone instruments, had *not* infringed Bell's patents; or, as the Bell Telephone Company contended, did Bell not merely invent an instrument, but discover how to use electricity for the transmission of speech,—in which case Gray, Dolbear and Edison and the Western Union Telegraph Company *had* infringed the Bell patents? This case ended without a judicial decision by the admission of the counsel of the Western Union Telegraph Company that the Bell patents were valid, that the Bell contention was correct, and that the only thing for his clients to do was to settle. This was done. The agreement was signed on November 10, 1879, and the settlement was approved and confirmed by the court. It is obvious that no judicial decision could have settled the matter in a more positive way.

Soon it was evident that there was a future for the telephone. There speedily sprang up countless infringing companies whose activities may be characterized generally as selling as much stock as they could to the public before they were sued for infringement and stopped by injunction,—with, in some cases, the hope in reserve that they might win out and fall heir to a negotiable interest in part or all of the telephone industry and the emoluments thereof. The Bell Telephone Company and its successors of course had to sue all of these for infringement. There resulted, in the words of Mr. Justice Brewer of the United States Supreme Court, "the most important, the most protracted litigation that has arisen under the patent system of this country." The record of this litigation takes up 149

volumes. The defendants in these cases availed themselves of many varied expedients to complicate the progress through the courts, reintroducing depositions and witnesses from other cases and sometimes with slight changes resubmitting issues that had essentially already been decided. Few cases, if any, stood alone independent of other cases. Indeed, the litigation as a whole constituted an involved, inseparably tangled network. Yet in the end Alexander Graham Bell and the Telephone Company won the litigation as a whole and every single lawsuit in it.

This outline is enough to understand and enjoy the inception of two of the most far-reaching myths in the history of the telephone. The first of these sprang from the activities of an enterprising character, Dr. Seth R. Beckwith, a man so shrewd and so resourceful as to make him a truly fascinating figure. To say that he was consummately able is not however to say that he was strictly scrupulous, except in the masterly discrimination with which he pursued his own ends. Dr. Beckwith appreciated the possibilities of the telephone business; he appreciated that it was a big business and that it could be a bigger business. He appreciated that anyone who undertook to contend with the Bell Company must be ready for stiff litigation. He laid his plans accordingly. In February, 1883, he organized the Overland Telephone Company in New York and proceeded to organize under it eight other Overland Telephone Companies as the beginning of a network of Overland Companies covering the whole country. These were skillfully co-ordinated with each other for purposes of concerted action, and at the same time kept skillfully interseparated from each other for purposes of legal strategy. He retained for himself 7,200 out of 10,000 shares of the stock of the main company, and took the position of General Manager, so that he controlled the company in every point of policy and of operation. For his apparatus he secured the telephone patents of one Myron L. Baxter of Aurora, Illinois. The application for

these patents was filed in December, 1882, and they were issued in May, 1883. It will be seen that Dr. Beckwith did not wait for the decision of the Patent Office on the merits of these patents; that was a secondary consideration. The Bell Company instituted proceedings against the Overland Company and the case promptly went to trial.

But Beckwith was not the man to neglect provision for future lines, either of retreat or of advance, as might be advisable. As the Overland case progressed during the summer and fall of 1883, Dr. Beckwith realized that his company might lose; he probably became convinced that it would lose. At any rate, on December 31, 1883, he quietly severed all connection with the Overland Company, whether as director, stockholder, or general manager. Accordingly when later the Bell Company won the suit and an injunction issued against the Overland Telephone Company, he had no longer any connection with the company, and no restraining order or injunction issued against the said Seth R. Beckwith. He had eluded the pursuit and was free to make another attack. We are now no longer interested in the fortunes or misfortunes of the Overland Telephone Company or of its attendant companies, no more than was Dr. Beckwith. Mythological possibilities followed the resourceful career of Dr. Beckwith. And so do we.

There was incorporated on April 2, 1883, in the State of New York, another telephone company, the Globe Telephone Company. There is nothing to show that Dr. Beckwith had anything to do with its organization, but it does not seem impossible that he instigated it as a reserve for use in case of need. It would be like him. Early in 1884, it began a tentative multiplication that suggested the plan of the Overland Company. Contrary to the practice in the Overland Company, however, the Globe Company remained singularly innocent of any commercial activity. A year later, the officers of the company certified that "$10,000,000 had been paid in,

in the form of property necessary to the business, namely patents and patent rights, and stock had been issued therefor." These valuable patents seem to have been the telephone patents of one George E. Shaw, but it does not appear that either any practical or any legal use was ever made of them.

Nothing happened in the Globe Telephone Company for another year. They were careful not to do anything that might subject the company to injunction for infringement. In June, 1885, however Dr. Beckwith became interested in Antonio Meucci of Staten Island, and things began to happen. At the same time Beckwith began to use the office of the Globe Telephone Company in the Mills Building in New York. A continuity in events may be indicated by the fact that one of Beckwith's directors in the Overland Telephone Company, Erastus Wiman, lived on Staten Island; he may have found Meucci for him. In August, 1885, Beckwith became a stockholder (5,000 shares) in the Globe Telephone Company and its General Manager. He said later that his services were confined to securing testimony regarding Meucci's inventions and evidence of fraud in the obtaining of Bell's patents. The last week of October, provocation having been sufficient, the Bell Company sued the Globe Telephone Company for infringement.

Meucci fitted perfectly into Beckwith's plans. From the Overland case Beckwith had learned that reliance on any telephone patents of later date than Bell's,—such as Baxter's, or Shaw's,—was vain. A claim must be based on new evidence, alleging invention prior to Bell's. Meucci really had invented, years before, what could, in the loose phraseology of the time, be called a telephone. To be sure, it was an acoustic and not an electrical telephone. He had filed a caveat for it in the United States Patent Office in 1871 and later renewed it twice, but he was never granted a patent. For that matter, others had invented acoustic telephones before he did. Further, Meucci was an aged Italian, 77 years old, a Garibaldi

veteran; he could speak English somewhat, but not readily. All these circumstances were handicaps to Meucci's interests in court, but they were distinct advantages for Beckwith's purposes. In brief, Antonio Meucci made a romantic figure and his claim properly handled might be the instrument for breaking the Bell Telephone patents.

Beckwith began the proper handling on the first day of the trial by pleading the age and foreign nationality of Meucci and of his chief witness, the 81-year old Domenico Mariani, and getting permission to have their testimony taken in the form of depositions, and thus minimizing their appearance in court. But the prospects in the Globe case proved to be no better than in the Overland case. So, about April 1, 1886, without interrupting the court proceedings, Beckwith withdrew entirely from the Globe Company, and while testimony was still being taken in that case, went over to Elizabeth, New Jersey and started another company, still using the claims of Antonio Meucci,—for which he offered the old man, but did not deliver, 100 of the 1,000 shares of stock, though retaining for himself 690 shares,—and boldly calling it the Meucci Telephone Company of New Jersey.

Naturally Meucci and his personal attorney, David Humphreys, did not like Beckwith's abandoning him in mid-trial, and when Beckwith was sued in New Jersey by the Bell Company and he proceeded to base his defense on Meucci's deposition, they objected strenuously, Humphreys accusing his former colleague and friend of "villainous misrepresentation" and so forth. But all that Beckwith could do was in vain. The Bell Company won the Globe case of course. While the Globe Company appealed to the United States Supreme Court, it never filed its briefs. Beckwith gave up his defense in the Meucci Telephone Company case in New Jersey. And that was the end.

But that was not the end of Meucci. Out of Beckwith's

exploitation of him arose the myth of Antonio Meucci as the inventor of the telephone.

It was the most natural thing in the world under the circumstances that Antonio Meucci himself and his Italian friends, not understanding the technical differences involved nor following easily the court proceedings, should believe that he had been defrauded and that the Bell Company was to blame for this miscarriage of justice. The banner of the lost cause was raised and under it many loyal Italians here in America have rallied ever since. Such a belief would of course supply them with a simple solution of the whole matter, and blind them to the real issue in the case. Yet there is not and never has been any ground for this belief.

This issue was very simple. As has been said, what Meucci invented was an acoustic telephone. Acoustic telephones operate by direct physical impulse and work very well over a short distance. Meucci's did. Alexander Graham Bell, on the other hand, discovered how to use electricity in the transmission of speech. By physical impulse the voice travels through the air, as in ordinary talking, singing or yodeling, at a speed of about 1,100 feet a second; through a string or a metal wire, maybe a little faster. By electricity the voice goes at the rate of 185,000 miles a second. This was the basic element in Bell's invention which was in no way a development of the acoustic telephone. Meucci thought he was using electricity. But with all respect be it said, he was mistaken,—nor is it surprising that he should be. He was not a trained scientist; his various inventions were not the result of systematic scientific research, as were the inventions of Edison, Elisha Gray or of Bell. In his caveat, Meucci stated that his "system consists in isolating two persons by placing them on glass insulators, employing glass for example at the feet of the chair or bench on which each sits." Probably he thought this would keep the electricity in, prevent it from escaping. Nowadays of course everyone knows that the glass insulation

would prevent there being any electric current at all. But Meucci's apparatus would work equally well with the insulation and without. Certainly; because it worked by physical and not by electrical impulse.

Myths are strange affairs. They are like clouds floating across the sky, none of them, even the highest, really very far from the ground. Like the myths in this article, they are quite different,—heavy or light,—some ephemeral and amusing, some grotesque, hardly to be taken seriously, some sinister. And they all speedily or slowly melt in the blue sky or pass on over the earth out of sight, are gone and forgotten. One more may be recounted here, the strangest of all, a dark cloud bearing tragic unhappiness in its piled-up masses and muttering with the distant echoes of a storm. It is the myth of Elisha Gray.

Elisha Gray was one of the prominent inventors of the latter half of the 19th century. He was thorough and systematic in his researches and experiments. His great invention was the multiple telegraph. While he was working on that, he gave some time and interest to the possibilities of transmitting speech by electricity. He succeeded in transmitting musical tones in that way. But that was a very simple matter compared with the transmission of the extremely complicated overtones of speech, which required an entirely different kind of electric current from the make-and-break current of telegraphy. Gray put his tentative ideas into form in February, 1876, and filed a caveat therefor in the United States Patent Office on February 14th.

But Alexander Graham Bell had invented his telephone nine months before, on June 2, 1875, and he then had a patentable article. In order to have his invention patented at the same time in England and in America he delayed filing his application until February 14, 1876, when he filed it, as it happened, a few hours earlier than Gray filed his caveat. The technical difference between the two is important. A caveat

serves notice with the Patent Office that the inventor expects to invent something, whereas an application asserts that the invention has already been completed. Therefore on February 14, 1876, Elisha Gray filed notice that he expected to invent a telephone, whereas Alexander Graham Bell filed notice that he had invented a telephone. In subsequent litigation the question of Elisha Gray's claim that he preceded Bell in the invention was adjudicated and decided in Bell's favor.

But the closeness of the times of filing became exaggerated in the minds of some people into real importance, and this was further exaggerated by the intense feeling of the ensuing litigation. Even Elisha Gray, as time passed, fell into this error himself. But not at first. Both Bell and Gray exhibited inventions at the Centennial Exhibition at Philadelphia that summer of 1876. On Sunday afternoon, June 25th, Bell demonstrated his telephone before the Judges of Electrical Instruments and Instruments of Precision. Elisha Gray himself was present. Among the judges were Sir William Thomson, later Lord Kelvin, and Prof. James C. Watson of the University of Michigan. In the scientific periodical, *Nature*, for December 5, 1878, Professor Watson told about certain experiments that he and Sir William made with Bell's telephone after Bell had returned to Boston and about Elisha Gray's comments on them.

> The news of these successful experiments soon circulated freely, and the day following, or possibly two days afterwards, Mr. Gray came to me and inquired whether the reports of our success with Bell's telephone were correct; and upon receiving from me an affirmative reply, he said that it was impossible, that we had been deceived in some way, that the transmission was by actual metallic contact through the wire, and that it was, to use his own words, " nothing more than the old lover's telegraph." In reply I said to him that we had taken every possible precaution against error, that we were both convinced of the reality of Bell's claims, and that Sir William Thomson would report to that effect. He persisted in his statement that the result was impossible, and that we must have been deceived in some way or other.

If Professor Gray was so sure that Bell's invention could be nothing more than another acoustic telephone, like Meucci's, and that an electric telephone was impossible, he could not have regarded his own caveat as asserting more than a chance that he might solve the problem, much less that he had already actually invented it himself.

However Professor Watson's statement is not the only evidence of this. Some friction arose between Bell and Gray on account of certain statements that Professor Gray made in a lecture in Chicago, and that seem to have been incorrectly reported in the press. In a letter that Elisha Gray wrote with his own hand to Alexander Graham Bell on March 5, 1877, he said of his lecture: "I gave you full credit for the talking feature of the telephone. . . . I described your apparatus at length by diagram." And again farther on in the same letter, —"I do not however claim even the credit of inventing it, as I do not believe a mere description of an idea that has never been *reduced* to *practice*—in the *strict sense* of that phrase—should be dignified with the name invention." (Italics Gray's.)

How could it be then, in view of these plain statements of his own, that Gray ever actually and (paradoxical though it be) sincerely believed that he antedated Bell in the invention of the telephone? He was not deceived, as Meucci was, by any one. He was competent to reach the truth of the matter from his own knowledge of electricity. It came about through an unaccountable habit of human nature. The strange fact was described in a sentence by Judge Sprague in Howe *vs.* Underwood: "After having seen what has been done, the mind is very apt to blend the subsequent information with prior recollections and confuse them together."

Beside this tendency common to most people, Gray was considerably older than Bell. He was of very serious nature; there was no lightness in his nature that would enable him to throw off disappointment and take defeat easily. It hurt his

pride that the young teacher should have invented what he had started to work on and which he had regarded as impossible. Then the floods of legal contention swept deliberation and calm judgment away in the swirling currents of the litigation. That he invented the telephone became *une idée fixe*. He brooded over the disappointments of the struggle and became an embittered man. When he died, there was found among his effects, a scrap of paper in his own writing on which was written:

> The history of the telephone will never be fully written; it is partly hidden away in 20 or 30 thousand pages of testimony and partly lying on the hearts and consciences of a few whose lips are sealed—some in death, and others by a golden clasp whose grip is even tighter.

From this it will be seen how cruelly sincere he was in the belief that it was he who invented the telephone. It is sad, tragic. And it is regretted especially in the Bell System, for Elisha Gray was one of the founders of the Western Electric Company and is honored, now that the bias of those days has passed away, for his own great merits. His empty claim has become a myth. His adherents in the days of the telephone litigation, and his friends, perpetuated his claim and rallied devotedly to him under the banner of the lost cause. But time is healing the wounds, and allaying the bitterness of former days. The Elisha Gray Collection in the Historical Library of the American Telephone and Telegraph Company preserves many of his papers and impartially welcomes any material pertaining to his claim. The facts are now recognized without prejudice on the one side and he is no longer accused of flagrant insincerity on the other. The Elisha Gray myth has now pretty much passed into the Valhalla of History along with the other myths, where they enjoy due recognition for their worth unhampered by any too literal allegiance to the more prosaic facts.

But one myth seems still to cling to earth,—the myth of Joshua Coppersmith. May he, too, soon go to "the bourne from whence no traveler returns"! Even there however he may have bad luck and be relegated to the stables to groom the horses, the winged steeds on which the others ride gleaming through the sunlit heavens.

WILLIAM CHAUNCY LANGDON

Notes on Recent Occurrences

OVERSEAS SERVICE EXTENDED TO CANAL ZONE, PANAMA, COSTA RICA, THE PHILIPPINES AND THREE CITIES IN PALESTINE

TELEPHONE service between the United States and the Republic of Panama and between the United States and the Panama Canal Zone was opened on February 24, and between the United States and the Republic of Costa Rica on March 20, by conversations between officials of the respective governments. On March 30 telephone service was opened between the United States and the Philippine Islands. Jerusalem, Haifa and Jaffa in Palestine were brought within reach of American telephone users on April 7.

These services embrace all Bell and Bell-connecting telephones in the United States, Canada, Cuba, and Mexico. The connecting links to the telephone systems of Panama, the Canal Zone, and Costa Rica are radio telephone circuits from the American Telephone and Telegraph Company's new short-wave station at Miami, Florida, to the station of the Tropical Radio Telegraph Company near Panama City and to that of the International Radio Company near San Jose. These are the fourth and fifth services to open through the Miami station, extension having been recently made to the Bahamas, Colombia, and Venezuela. The charge for a 3-minute call between New York and the Republic of Panama or the Republic of Costa Rica is $21. Charges to the Canal Zone are the same.

Telephone connection with the Philippine Islands is established through short wave radio telephone stations near San Francisco and Manila. The opening of service to the Philippines marks the second step in the expansion of Bell System telephone service across the Pacific. Connection with the Hawaiian Islands through the California stations was made

late in 1931. Tests are already in progress looking to the eventual establishment of service with Japan and other points in the Far East.

A three-minute conversation between San Francisco and Manila costs $30. Charges for calls with cities in the Middle West and East are greater, depending on the distance involved. The service includes all Bell and Bell-connecting telephones in the United States, Canada, Cuba and Mexico.

Jerusalem, Haifa and Jaffa, in Palestine, are reached by connecting the regular transatlantic radio telephone circuits with a short wave channel between London and Cairo, Egypt, and land wire facilities out of Cairo. This service, also, embraces all Bell and Bell-connecting telephones in the United States, Canada, Cuba and Mexico. A three-minute conversation between New York and Palestine costs $37.50.

PUBLIC RELATIONS CONFERENCE

A CONFERENCE of Bell System officials and department heads in charge of public relations was held at New York from March 7 to March 9, inclusive, under the leadership of Arthur W. Page, Vice President of the American Telephone and Telegraph Company. Other participants from that company included President Walter S. Gifford, Vice-Presidents E. F. Carter and Bancroft Gherardi, S. L. Andrew, Chief Statistician, K. S. McHugh, Commercial Engineer, and members of the Information Department.

ANNUAL MEETING

THE annual meeting of the stockholders of the American Telephone and Telegraph Company was held on Tuesday, March 28th. The Board of Directors was re-elected There had been no change since the preceding annual meeting in the number of shares of stock outstanding, 18,662,275, although the number of stockholders had increased by nearly 33,000.